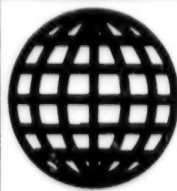


JPRS-EST-94-030
2 November 1994



**FOREIGN
BROADCAST
INFORMATION
SERVICE**

JPRS Report

Science & Technology

Europe/International

This report may contain copyrighted material. Copying and dissemination is prohibited without permission of the copyright owners.

Science & Technology

Europe/International

JPRS-EST-94-030

CONTENTS

2 November 1994

WEST/EAST EUROPE

ADVANCED MATERIALS

France, Belgium to Produce High-Temperature Aerospace Ceramic [Paris AFP SCIENCES, 15 Sep 94]	1
German Project on Diamond, Cubic Boron Nitride Coating Noted [F. Miller; Berlin WT—ZEITSCHRIFT FUER INDUSTRIELLE FERTIGUNG, Sep 94]	1
Germany: Polymer With Faster Charge Exchange Studied for Materials Applications [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 28 Sep 94]	2
Germany: Controlled Introduction of Microcracks Reduces Crack Susceptibility in Ceramic Workpieces [J. Grubitsch; Berlin INGENIEUR DIGEST, Oct 94]	2
Germany, Poland, Russia Discuss Use of Metal Hydrides [Duesseldorf HANDELSBLATT, 5 Oct 94]	3

AEROSPACE

Netherlands: Improved Bacterial Air Filter Tested for Aerospace [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT 19 Sep 94]	3
Netherlands: Fokker, DASA Plan New Supersonic Aircraft [Paris AFP SCIENCES, 29 Sep 94] ...	4
France: Airbus Confers With Airlines on A3XX Superjumbo [J. Casamayou; Paris AIR & COSMOS/AVIATION INTERNATIONAL, 16 Sep 94]	4
France To Invest 9 Billion Francs in Two Satellite Programs [Paris LE MONDE, 19 Oct 94]	5
France: First Ariane 5 Flight Scheduled for 29 November 1995 [Paris ESA PRESS RELEASE, 20 Oct 94]	6
ESA To Build Manipulator Arm With Russia [Paris AIR & COSMOS/AVIATION INTERNATIONAL, 23 Sep 94]	6

AUTOMOTIVE, TRANSPORTATION

Germany: New Engine Concept Utilizes Propane, Reduces Noise Level [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 5 Oct 94] .	7
--	---

BIOTECHNOLOGY

Genetic R&D at German Cancer Research Center Reported [Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN, 18 Sep 94]	7
Lignin Formation Improved Through Gene Technology [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 28 Sep 94]	8

DEFENSE R&D

Italy: Delay in Eurofighter Prototype Test Flight [J. Casamayou; Paris AIR & COSMOS/AVIATION INTERNATIONAL, 23 Sep 94]	8
Spain To Launch First Minisatellite for Defense Purposes [Madrid EL PAIS, 20 Oct 94]	9

ENERGY, ENVIRONMENT

Germany: Single-Crystal Photovoltaic Cells Developed for Energy Conservation [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 21 Sep 94]	9
Germany: Hollow Fiber Module Removes Heavy Metals from Sewage [Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT, 23 Sep 94]	10

Germany: Hoechst Chemists Develop Material To Destroy Ozone [Berlin <i>INGENIEUR DIGEST</i> , Oct 94]	11
Germany: AVR Research Reactor Promising for Environmental Protection [R. Goering; Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 5 Oct 94]	11
EU Appraises Biofuel Option in Fossil Fuel Conservation [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 4 Oct 94] ..	12

ADVANCED MANUFACTURING

ESPRIT Project on Robot Interoperability Discussed [F. Mikosch; Berlin <i>WT—ZEITSCHRIFT FUER INDUSTRIELLE FERTIGUNG</i> , Sep 94]	13
---	----

LASERS, SENSORS, OPTICS

Ireland: PEAT Electron Microscope Helps Materials Analysis [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 20 Sep 94]	16
Germany: Laser Device Aids Particle Analysis [P. Winandy; <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 4 Oct 94]	16
Germany: Thirty-Kilowatt Welding Laser Developed [Duesseldorf <i>HANDELSBLATT</i> , 5 Oct 94]	16

MICROELECTRONICS

German Institute Develops Chip for High Speed Calculations [Duesseldorf <i>HANDELSBLATT</i> , 19 Sep 94]	17
Pan-European JESSI Program Helps Semiconductor Industry 'Catch Up' [Zurich <i>NEUE ZUERCHER ZEITUNG</i> , 16-17 Oct 94]	17

SUPERCONDUCTIVITY

German Research in Superconductor Applications Detailed	18
Government Research Support [Duesseldorf <i>HANDELSBLATT</i> , 28 Sep 94]	18
Electricity Storage Research [Duesseldorf <i>HANDELSBLATT</i> , 28 Sep 94]	19
Current Limiters Research [Duesseldorf <i>HANDELSBLATT</i> , 28 Sep 94]	20

TELECOMMUNICATIONS

West European Telecommunications To Be Improved with Swedish-German Undersea Cable [Frankfurt/Main <i>FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT</i> , 26 Sep 94]	20
France: Gerard Thery Proposal on Information Superhighway Presented	20
General Outline [Y. Mamou; Paris <i>LE MONDE</i> , 24 Oct 94]	20
Accessibility Issues [Y. Mamou; Paris <i>LE MONDE</i> , 24 Oct 94]	21
Existing Components [Y. Mamou; Paris <i>LE MONDE</i> , 24 Oct 94]	22
Role of France Telecom [Y. Mamou; Paris <i>LE MONDE</i> , 24 Oct 94]	22

INTERNATIONAL

BIOTECHNOLOGY

Mexican Biotechnology Institute Research Profiled [P. Suarez; Mexico City <i>LA JORNADA (R&D September Supplement)</i> , 12 Sep 94]	24
--	----

ENERGY, ENVIRONMENT

Mexico: Resistol Group Initiates Environmental Megaproject [L. Pena; Mexico City <i>LA JORNADA (R&D September Supplement)</i> , 12 Sep 94]	25
---	----

ADVANCED MATERIALS

France, Belgium to Produce High-Temperature Aerospace Ceramic

BR1810155394 Paris AFP SCIENCES in French
15 Sep 94 p 16

[Unattributed report: "A French-Belgian Agreement on a New Thermal Protection Material"]

[FBIS Translated Text] Paris—Conventions to produce and exploit a new ceramic powder, intended for component thermal protection, particularly in the aeronautics and space sectors, have just been signed by the Atomic Energy Commission (CEA) with the firms Techspace Aero (Belgium) and Baikowski Chimie (France). This was announced on 14 September by the CEA.

Under these conventions, the CEA, which is the owner of the manufacturing process for this ZIRCYT (zirconia yttrate [zirconium yttride]) powder, has given Techspace Aero the exclusive right to manufacture, use and sell this powder which can resist very high temperatures. Baikowski Chimie will manufacture the powder on behalf of Techspace Aero and will ensure that it is made available to other sectors.

In its research work on thermal barriers, which can be applied to the crucial parts of turboreactors, the Belgian firm has worked out a process for plasma projection which allows this ceramic powder to be deposited on metallic superalloys, particularly in the combustion chambers of turboreactors.

Moreover, the new ceramic and its application process increase resistance to erosion, to thermal shocks, oxidation and heat corrosion of thermal barriers, and thus extend the life span of hot parts.

It is the Center for Studies and Research on Materials (CERM) of the CEA which has developed the synthesis process and the formation of Composite Ceramic powders from their basic constituents, this is the process applied to the production of stabilized zirconia, namely ZIRCYT.

German Project on Diamond, Cubic Boron Nitride Coating Noted

95WS0008B Berlin WT—ZEITSCHRIFT FUER
INDUSTRIELLE FERTIGUNG in German Sep 94 p 438

[Article by F. Miller: "Super-Hard Layers from Diamond and Cubic Boron Nitride"]

[FBIS Translated Excerpt] [passage omitted] Steel is such an important basic material for tools and structural parts that the Federal Ministry for Research and Technology (BMFT) has decided to support the CVD [chemical vapor deposition] diamond coating of steel. The

following are participating in the 9-million German mark [DM] cooperative project, half of which is financed by the BMFT: the Research Center Juelich KFA as project sponsor; CermeCon Ltd., Aachen, as commercial coater and manufacturer of coating systems; Daimler-Benz Inc., Research Center Ulm, and Siemens Inc., Berlin, both of which use steel tools in their enterprises; and the tool manufacturer United Hardmetal Ltd., Horb at the Neckar. The Fraunhofer Institute for Coatings and Surface Technology IST is responsible for coordination of the research and development tasks.

The essential research and development tasks are: to decrease below 500°C the temperatures which are necessary for the precipitation of diamond, to suppress the diffusion processes between the growing diamond layer and the steel substrate, and, finally, to achieve a sufficient adhesion of the layers.

Missing are only super-hard coatings with which ferrous materials can be worked on. Therefore, as an ideal supplement to diamond coating, the BMFT supports a parallel-research cooperative project, "Layers of Cubic Boron Nitride," which encompasses about DM10 million.

Cubic Boron Nitride (CBN) belongs, next to diamond, to the super-hard materials. Also, the electrical and optical properties are similar to those of diamond. "In contrast to diamond, which reacts with iron and is subject to chemical wear and tear when working steel," Matthias Fryda explains, "cubic boron nitride is very well suited, even at high temperatures, for working iron-containing engineering materials." The excellent properties of cubic boron nitride promise, in addition, futuristic applications in traffic and energy technology, as well as in communications technology and medicine.

Worldwide, however, the development of cubic boron nitride layers is only in its infancy. A prerequisite for the practical application of layers of cubic boron nitride for wear protection in electronics or optics is good adhesion [of these layers]. Especially on tools, layers several micrometer thick are required. At present, various adhesion-promoting intermediate layers are being tested, but no break-through has yet been achieved.

The project sponsor of this project cooperative is the Research Center Juelich KFA; the coordinator is the Fraunhofer Institute for Layer and Surface Technology. In addition, there are the industrial enterprises, Siemens Inc., Krupp Widia, Salzgitter Surface Technology, Leybold Inc., and Wear-and-Tear Protection Technology Keller in Schopfheim, as well as the Work Group Technical Physics of the TU [Technical University] Chemnitz-Zwickau.

The essential prerequisite for success in the marketplace is that the coatings technologies be economical. The goal is: super-hard layers in tough competition.

Germany: Polymer With Faster Charge Exchange Studied for Materials Applications

95WS0003B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Sep 94 p 8

[Unattributed Article: "Polymer With Fast Charge Exchange—May be Usable for Antistatic Varnishes and Photoconductors"]

[FBIS Translated Text] Researchers at the Physics Institute of the University of Bayreuth found a polymer with very high values for the exchange of electric charges. As professor Dietrich Haarer (Universitaet Bayreuth, Physikalisches Institut, II, D-95440 Bayreuth, Germany) reports, with 0.1 square centimeter per volt and second, the sulphurous phenylene (hexa-hexyl thiophenyene, HHTP) reaches the highest value of an organic compound and comes close to the charge exchange values usually found in semiconducting materials.

Because of its high charge exchange speed, HHTP could be used together with organic photoconductors and greatly increase their working speed. A few laser printer or photocopier manufacturers are already using organic photoconductors instead of photoconductors which contain selenium. Another possible use is in light-emitting diodes made of organic materials. In this case the material could improve the active light-emitting layers. Or they could be used in transistors made of organic compounds. Such organic compounds offer a number of advantages for the production of these electronic circuits and components, because polymers are cheaper to produce and easier to process. The polymer shows that it is the molecular structures in particular which are responsible for the fast charge exchanges. These structures are disc-shaped molecule slices which are put together as liquid crystals to form column-like structures.

At present, the best use for the new conducting liquid crystals has not been established. However, since BASF [Baden Aniline and Soda Works] participated in the research and development projects and would be able to produce the crystals, a possible application might be antistatic varnishes or coatings, or possibly inexpensive shielding layers against electromagnetic interferences. In this case, use of the liquid crystals would be very advantageous since they can easily be applied to large areas.

Germany: Controlled Introduction of Microcracks Reduces Crack Susceptibility in Ceramic Workpieces

95WS0016A Berlin INGENIEUR DIGEST in German Oct 94 p 16

[Article by Dr. Juergen Grubitsch: "Unbreakable Cracks"]

[FBIS Translated Text] "Microstructural design" is what Dr. Joerg Woltersdorf calls his method of depriving ceramics of their notorious brittleness: "By intervening

at the lowest structural level, we want to create changes that macroscopically result in the desired properties." Clever compound materials with carbon and silicon fibers, for example, possess a breaking strength of several gigapascals. That overshadows even the toughest steel (0.3 to 0.8 GP).

There is an urgent industrial need for it, because ceramic materials possess properties which predestine them for many tasks: they are hard, chemically durable and high-temperature resistant. As early as the mid-1980s the world market for these high-tech materials reached the 4-billion-dollar level. Experts predict a five-fold increase by the turn of the century. In return, the tendency to crack resulting from the excessive brittleness must be eliminated.

This goal is what the working group for interfaces and material systems of the Max Planck Institute for Microstructure Physics at Hallenser Weinberg has set for itself. Dr. Woltersdorf, head of the research team, compares the fracture processes in ceramics to those in metals, in which the atoms are arranged in regular grids. At the tip of a crack that is spreading in a metallic material there is usually a development of plastic zones: At the tip of the crack the high mechanical tensions activate crystal formation errors which become visible under the electron microscope. The crystal movements cause a plastic deformation of the grid structure. The crucial point: The formation of plastic zones consumes part of the energy that causes the crack: "In this way some cracks dig their own grave, to some extent," as Woltersdorf describes the course of these processes.

For ceramic crystals it is different. In order to achieve a crystal dislocation and a plastic deformation, considerably higher activation energies are needed than for metals. Below 800°C there is nearly complete lack of movement. The result is brittle fracture.

"In order to supplement the hardness with fracture strength, means must be used which are not supplied by nature," Woltersdorf explains. A striking variant: Interior surfaces are produced by means of controlled introduction of microcracks. Other possibilities: The plastic workability is achieved by bringing in a second material component. Or: compressive stresses are deliberately triggered by the transformation of a second phase or cracks are rerouted to suitable particles.

These solutions are already being applied in practice. In the past, coincidence and empirical experience were usually the reasons for their development. For this reason something that has proved itself in one case can rarely be just applied to other materials. The Hallense people want to bring systematic practice into the developments. That is why to begin with they started with the depths of the micro- and nanostructures. Their first exploration of the interface concept brought results as early as the mid-1980s: a multiphase, highly wear-resistant ceramic material for biological implants. The figure at bottom left [not included] shows the cross section of the interface of a fiber-reinforced ceramic [key omitted].

Theoretical knowledge was thus acquired regarding friction-inhibited gliding and energy-consuming pull-out effects. They assure residual strength and a damage-tolerant behavior.

The electron microscope illustration (photo above [not included]) shows the crack process along the interface between fiber and graphite layer for a composite material (tyranofiber/SiC matrix). The pull-out effect makes the material considerably more fracture resistant.

The practical effect of the research is newly developed high-performance materials, such as cutting ceramics, heat shield materials and combustion chamber materials for engines, for example, which thanks to higher temperatures have lower pollutant emissions.

The Hallense results have long been highly valued. In addition to the universities of Hamburg and Karlsruhe, as well as the Freiberg Mining Academy, well-known high-tech firms such as Schott Mainz and MAN-Technologie Munich, IKTS [Fraunhofer Institute for Ceramic Technologies and Sintered Materials] Dresden and Dornier Friedrichshafen-Deutsche Aerospace are among the closest cooperation partners.

Germany, Poland, Russia Discuss Use of Metal Hydrides

95WS0010C Duesseldorf *HANDELSBLATT* in German
5 Oct 94 p 31

[Article by "beh" under the rubric "Research and Technology": "Solid State/Gathering of Experts at Saarbrücken University. Hydrogen As Jack of All Trades"]

[FBIS Translated Text] Duesseldorf, Tuesday, 4 Oct 94, Handelsblatt—On the weekend experts from Germany, Poland and Russia discussed the properties of hydrogen in solids and how such systems are to be utilized. Said Rolf Hempelmann, professor of physical chemistry in Saarbrücken and organizer of the colloquium in Homburg, "It is scarcely known that hydrogen is absorbed as by a sponge by certain metals and also by just recently developed ceramics. It displays interesting new properties in this case."

Though the solubility of hydrogen in metals has been known for some time already, it has been utilized commercially only recently, for instance, in rechargeable nickel-metal hydride batteries, which are already being sold in large numbers by the Japanese. The voltage and outside measurements equal those of the well known nickel-cadmium batteries, but the environmentally hazardous poison cadmium is replaced by a metal hydride that causes no environmental problems when it is disposed of.

Certain ceramics that can dissolve hydrogen represent a totally new kind. However, here the hydrogen is not present in neutral atomic form as in metals, but is positively charged in the capacity of a so-called proton. Says Hempelmann, "With ceramics one normally thinks of a hard, solid material. However, at the atomic level this does not hold true for the protons. On the contrary. In these

outwardly solid ceramics the protons can move as in a fluid and hop constantly from lattice position to lattice position. The electrons in these substances are far from being so mobile. Fast protons and slow electrons result in a special kind of conductivity, that is, in proton conductivity. Therefore, we talk about solid proton conductors."

The team at the Institute for Physical Chemistry of Saarbrücken University was able to explain the other day how the proton conductivity that can be measured easily with an electrical instrument is linked to the atomic hopping processes of the protons.

Effects that to some extent have already found an application are based on the proton conduction of the new ceramics. Similar to the lambda probe in up-to-date vehicles that measures the oxygen in exhaust gas, a ceramic-based hydrogen sensor can be used in aluminum-making in order to eliminate hydrogen blisters in aluminum casting. An equivalent device is being offered by a Japanese company. Thin-film technology could be of importance for hydrogen sensor technology. Saarbrücken University's Institute for Physical Chemistry recently succeeded in making by means of the so-called sol-gel process thin films of proton-conducting ceramics. Now the integration on a single silicon chip of the sensor and the accompanying measuring electronics is to be considered.

The construction of high-temperature fuel cells for use in power plants is a long-term objective of the development work being done by the Jülich research center, also represented at the gathering of experts. Hydrogen captured in ceramics could play a key role as a current carrier here. By means of fuel cells a fossil fuel can be converted directly into electricity, and by electrochemical means, that is, and not by the high-loss and environmentally polluting roundabout route via the burning process.

AEROSPACE

Netherlands: Improved Bacterial Air Filter Tested for Aerospace

94WS0530A Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT*
in German 19 Sep 94 p 10

[Article by ghi: "Biological Air Filter Tested"]

[FBIS Translated Text] *Frankfurt*. The European Space Travel and Technology Center in Noordwijk has successfully tested an improved prototype of a self-regenerating bacterial air filter (Bacterial Air Filter—BAF). A report by the ESA (European Space Agency) states that the mathematical models were validated by experiments. This makes an important advance in the development of biological air filters which are desired for space vehicles and for which there would also be uses on earth. The new filter exploits the interaction between membrane filters and the targeted populations of non-pathogenic microorganisms. A hydrophobic membrane material performs a double function: on the one hand, a microbial film

adheres to it and, on the other hand, it separates the air to be purified from the aqueous phase of the "biofilm." The bacteria show a high affinity for the pollutants which are biologically decomposed and converted through oxidation into water, carbon dioxide, and salts. Out of several hundred pollutants, about 100 were selected for testing and assigned to 14 main chemical groups. In this manner it was possible to prove that almost all the pollutants that are released on board a space vehicle can be biologically decomposed. For additional information: contact Pierre Brisson, FT Division, Estec, Postbus 299, NL-2200 AG Noordwijk.

Netherlands: Fokker, DASA Plan New Supersonic Aircraft

*BR2010144994 Paris AFP SCIENCES in French
29 Sep 94 p 7*

[Unattributed report: "Fokker/DASA Plan Supersonic Aircraft to Replace the F-130"]

[FBIS Translated Text] Schiphol—A Fokker spokesman stated on 28 September that Fokker and German Aerospace are planning a new-design supersonic aircraft for the next century (FAX) to replace the Fokker-130 project.

Speaking during the ceremonies organized at Amsterdam's Schiphol airport to mark Fokker's 75th anniversary, Mr. Leo Steijn said that Fokker and DASA must decide before the end of the year whether they will take another partner on board. He added: "We have formally approached British Aerospace, but no negotiations are currently under way."

The celebrations took place against the backdrop of the official presentation of the latest addition to Fokker's jet aircraft range, the F-70. The project for the F-70, a smaller version of the F-100, was launched in 1993. The Dutch aircraft maker thus intends consolidating its position as leader in the regional aircraft market.

Fokker CEO Ben Van Schaik reiterated that the Dutch manufacturer, initially specialized in combat aircraft, had envisaged the first passenger aircraft as early as 1919 and "for a number of years laid claim to the title of the largest aircraft manufacturer in the world." Currently, the fourth largest commercial aircraft manufacturer in the West, Fokker nearly collapsed last year before being saved from bankruptcy by DASA.

France: Airbus Confers With Airlines on A3XX Superjumbo

*BR1910113294 Paris AIR & COSMOS/AVIATION
INTERNATIONAL in French 16 Sep 94 pp 30-31*

[Jean-Pierre Casamayou article: "Heading for the Launch of the A3XX Superjumbo."]

[FBIS Translated Text] Airbus Industries is launching preliminary studies on a 515-ton aircraft which can carry between 550 and 960 passengers over 15,000 km. Eight airlines are being consulted.

The European consortium has just taken a further step to launch a superjumbo provisionally called A3XX. It has just begun an information briefing with eight airlines, several airports, the certification bodies, and the consortium's suppliers. The aim is to get the views of all parties concerned in order to get a better definition of the superjumbo. At the same time, Airbus Industries is continuing its conversations with Boeing on the topic of the VLCT (very large transport airplane).

Today all four parties agree with the configuration of the A3XX. Out of the various projects studied since 1989, they have chosen a four-engine aircraft with a two deck ovoidal fuselage, which can carry between 550 and 850 passengers during the first phase, then up to 960 in a later version with a streamlined fuselage. And with a capacity to travel non-stop from 13,000 km to more than 15,500 km.

The feasibility studies which were started in 1993 by an integrated team under Jean-Jacques Huber, have made it possible to clear the ground and list the main stumbling blocks in the project. Moreover, and on a parallel basis to these studies, Airbus Industries has launched a technological action plan dealing in particular with the materials, rolling strength or engine integration. According to the director of the A3XX program, these actions should make it possible to choose the major options before implementation begins around 1998.

In fact, this superjumbo A3XX will have good offshoot potential, and other aircraft will be designed from it. The A3XX-100, the basic version, could be developed into an A3XX-200 with a fuselage extended by 7.5 meters, then into an A3XX-300 with greater capacity. A very long haul version (15,500 km distance) could be envisaged. "Because of the aircraft's design we are not limited in the amount of fuel we can carry," Jean Jacques Hubert explains. "Thus the A3XX could carry up to 290 tons of fuel". Depending on the version, the maximum take-off mass would range from 471 tons to 515 tons for the heaviest model.

The fuselage chosen for the A3XX is to be ovaloid in shape. It will be able to have two bridges and a hold which could carry containers and pallets of all types. The lower deck will be the same width as a 747 and the upper deck that of an A340. Thus a seating configuration can be planned as follows: eight (or seven) abreast on the upper deck, ten (or nine) abreast on the lower deck. Two staircases in front and behind the cabin will lead to the upper deck, while nine exits placed on either side of the fuselage will make it possible to evacuate the aircraft quickly: up to 110 passengers per minute and per door. Finally it should be noted that the cabin will benefit from technical progress in modular structure, which will make it possible for the A3XX to be used in a high number of configurations.

With such a number of passengers, obviously in-flight service will be a major challenge in logistic terms. One of

the solutions envisaged is thus automatic or semi automatic loading of food and drink supplies, with a distribution of the same type to passengers. As there will be so much room in the passenger cabin, entertainment could be provided for passengers: big-screen cinema, a relaxation area or exercise area, bar etc.

Another problem which will require a solution will be how to integrate these giant aircraft in the airports. "There is, at present a consensus on the part of the main world airports that these new generation aircraft will have to fit in an 80 m pad" Jean-Jacques Huber explains. The engineers have thus defined an aircraft which complies with these limits.

The wing should have a span slightly over 77 m, that is 13 m longer than the 747, with fineness ratio of 8.2 to 7.5. But one of the hard points to solve will be the wing root with the wing/fuselage join. In fact, for the aircraft to perform well at low speed the wing will have to have a big surface area (more than 700 square meters). This means the cord rope casing will have to be long, at least 16 m compared to 10 m for an A340, for example, with a thickness of at least two meters. One can easily imagine the difficulty in making a perfect wing/fuselage join in aerodynamic terms, with a wing this size.

The length of the superjumbo should be about the same as the 747, that is, about 70 m. There is another problem, namely the design of an undercarriage which can bear the weight of such a heavy aircraft mass. The preferred option is to have four main titanium landing-gear with six wheels each. Finally Jean-Jacques Hubert guarantees that to make the aircraft perform more effectively, drag will be reduced by using rolling techniques on the tail unit and cars. One should also note that carbon composites are to be extensively used for much of the wing, as well as new aluminum alloys which take up less volume.

On the propulsion aspect, the project manager insists that the engines being used at present on the A330 will be enough. The CF6-80EI, Trent 700 and PW4168 with a 310 kiloNewton [kN] thrust will be used for the first models A3XX-100. For later versions (A3XX-200) engines with a 340 kN thrust will suffice. The new generation of giant engines, like the GE90, will not be necessary. With present engines and technological developments included in the aircraft, the operating cost of the A3XX should be 15 to 25 percent cheaper than the 747-400, with a 25-35 percent lower fuel consumption. Likewise, the noise level will be three to four decibels lower than the "stage three" norm.

These preliminary studies on the A3XX superjumbo show quite clearly that the consortium has made up its mind to go ahead with this adventurous project, which is evaluated at \$8-10 billion. In fact, in addition to the fact that the Europeans want a full range of aircraft with a superjumbo equivalent to the Boeing 747, market studies have been done by Airbus Industries. These studies show a requirement for 13,400 airplanes with an average capacity of 251 seats by the year 2011, but 71

percent of these will be provided by superjumbos, given that airport platforms run the risk of becoming saturated. "Given that the 747-400s on our books at the moment already meet 19 percent of requirements, we think that 39 percent of future demand will be met by the 747 or larger category aircraft," Airbus Industries thinks. Thus the market is evaluated at a thousand superjumbos. Moreover, as the aircraft with more than 400 seats will make up 40 percent of the total amount of the market, the promoters of the A3XX think that it is justified to launch the superjumbo. Their targets are the airlines with a large fleet of 747s and which already have a requirement for a superjumbo, like British Airways, Singapore Airlines or Cathay Pacific, and also the Japanese airlines.

But despite the fact that the consortium partners prefer this A3XX option, on a parallel basis, Airbus Industries is continuing its discussions with Boeing. The American aircraft manufacturer is working on an NLA (New Large Aircraft) concept, based on the double-deck 747, which is a modernized version. Boeing is working with the Europeans on the VLCT project. The aim of the discussions is to define what future cooperation might entail in order to develop and build a family of superjumbos. Phase Two should be completed next June and the results, along with the decisions made, should be submitted at the next Bourget Fair.

France To Invest 9 Billion Francs in Two Satellite Programs

BR2010154094 Paris LE MONDE in French
19 Oct 94 p 17

["J.-F.A." report: "France Launches Two New Satellite Programs Worth 9 Billion Francs"]

[FBIS Translated Text] By deciding to launch the development of two new French satellites, Edouard Balladur's government has reaffirmed its determination to continue its efforts in the space sector. It is a "strategic area and one of national sovereignty which requires determined action by the state," the prime minister stressed.

The government, whose intentions in the space sector have long been awaited, recently stressed its priorities as follows: strong involvement in the military field; opting for Europe in scientific programs and heavy infrastructure; determination to make the future heavy launch rocket Ariane 5 as competitive as possible; finally, it has decided, as rumored, that the national framework will be given the advantage in any operational programs with commercial implications.

This strong boost for national programs orientated toward practical applications in space will be translated by the launching of two new programs with a total value of 9 billion French francs [Fr]: Spot-5 and Stentor.

The first of these programs, as presented by the CNES [National Center for Space Studies], concerns the observation of the earth from space. For this purpose work is

to start on the construction of two satellites, Spot-5 A and Spot-5 B. They are intended to ensure the continuation of the remote detection service currently provided by Spot-3, which was launched in September 1993, and the future services of Spot-4, to be launched in 1997. These two new 3,600-kg satellites, which will require investments of Fr6 billion, will be capable of distinguishing from space details down to 5 m, compared to 10 m previously. Spot-5 A is to be launched by Ariane in 2002.

The second program, Stentor, concerns space telecommunications and is the fruit of the studies by the Sillard commission. Weighing 1,500 kg, it will be a technological satellite managed by the CNES, France Telecom, and the general armament department. It is intended for the development of new techniques in order to strengthen French industry in space telecommunications. (Matra Marconi Space is to be the project manager of the Spot program, which is realized in cooperation with Belgium and Sweden. The same company will also be the joint project manager of the Stentor program along with Aérospatiale and Alcatel Espace). The Stentor satellite, for which Fr3 billion has been put aside, is to be launched by Ariane during 1999.

These government decisions will lead to the CNES gaining an increase in the civil research and development budget of Fr500 million in 1995. This immediate initiative should be accompanied by another, covering the future of French space policies. The prime minister has asked Research Minister Francois Fillon to prepare a report on the issue. Areas covered will be civil space research, manned flights, and long-term scientific activities. An initial report is to be presented on 15 December and the final report on 15 April, in the runup to the meeting of European space ministers planned for the autumn.

France: First Ariane 5 Flight Scheduled for 29 November 1995

BR2110090694 Paris ESA PRESS RELEASE in English 20 Oct 94 pp 1-2

[Unattributed report: "Firming Up Dates for the Ariane-5 Qualification Flights"]

[FBIS Transcribed Text] Paris 20 Oct—The stage reached in Ariane-5 development means that the qualification flight dates can now be firmed up. The European Space Agency (ESA) and the French Space Agency (CNES), in liaison with the relevant firms, have accordingly carried out a detailed review of the Ariane-5 time schedule leading up to the 501 and 502 flights.

The Ariane-5 development programme has now entered a phase of intensive testing of the launcher's main components (P230 solid booster, H155 cryogenic stage, L9 storable-propellant stage) and the associated ground infrastructure:

—Of the seven full-scale firings of the P230 solid booster planned under the programme, four have been successfully carried out to date. In the most recent test, which took place on 30 September, the configuration of the booster as regards its structure, the device attaching it to the launcher's central body and the on-board nozzle actuation system was similar to the in-flight configuration.

—Since 5 September, the H155 cryogenic stage has been undergoing a campaign of "battleship" tests using a reinforced (battleship) stage together with other items of equipment virtually identical to their flight hardware counterparts, such as the Vulcain engine and all the on-board fluids. The stage is fixed to the launch table and connected to the fluids and electrical systems in the launch zone and to the monitoring and command systems and associated software. With this set-up it is possible to validate all filling and draining operations, together with engine pre-cooling, ignition and operation and any malfunctions associated with all these activities. The results obtained so far generally conform to predictions.

—The L9 storable-propellant stage successfully completed its first long-duration test (1075 seconds) on 5 October. This test follows on from a series of firings of the Aestus engine that powers this stage.

—Development and testing of the components comprising the launcher's upper section are going according to plan.

—The ground infrastructure in French Guyana has been completed and is operational except for the final assembly building, which is not needed until May 1995 and will be ready in March of that year.

This encouraging programme situation, combined with the positive results of the test campaigns under way, can be taken as confirmation that the 501 flight remains scheduled for autumn 1995, with 29 November as the target date. The four satellites in Cluster, one of the projects in ESA's science programme, will be passengers on that flight. The 501 flight date means that the date of 3 April 1996 can be maintained for the 502 flight.

The first operational Ariane-5 flight (503), to be conducted under the responsibility of Arianespace, remains scheduled for October 1996.

ESA has delegated the management of its Ariane-5 programme to CNES.

ESA To Build Manipulator Arm With Russia

BR2010143394 Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 23 Sep 94 p 7

[Untitled, unattributed report]

[FBIS Translated Text] The European Space Agency (ESA) has decided to build a manipulator arm together with Russia for the future international Alpha orbital

station. The cost of this participation is estimated at \$180 million. Meanwhile, no decision has yet been made regarding the EVA-2000 extravehicular pressure suit.

AUTOMOTIVE, TRANSPORTATION

Germany: New Engine Concept Utilizes Propane, Reduces Noise Level

95WS0013C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 5 Oct 94 p 8

[Article: "New Turbine Designs Save Fuel and Lower Noise Level"; Subhead: "Shrouded Propfan Realizes Amazing Bypass Ratio, Quiet Airbuses"]

[FBIS Translated Text] Frankfurt—Cost minimization and enhanced environmental friendliness currently rank uppermost in the acquisition of new turbines. Empirical studies by the German Aerospace Research Institute (DLR) and the German-French research program, Measurement of Ozone on Airbus In-Service Aircraft, MOSAIC for short, provide reliable data based on regular measurements for reducing the existing and anticipated pollution of the ozone layer.

Out of a total of five Airbus A340-type aircraft taking part in the MOSAIC project, two belong to the Lufthansa fleet. Each of the aircraft are transporting more than 100 kilograms of measuring instruments on board that determine at four-second intervals the moisture vapor and ozone content of the atmosphere from takeoff to landing of each flight.

Apart from natural emitters, such as volcanic eruptions and lightning discharges, aircraft and rockets are the sole sources of pollutants in the stratosphere. Long-haul flights via the polar region entailing 8,000-meter flight altitudes in the stratosphere have now been introduced. The nitrogen that is released there triggers reactions with the ozone.

Turbine manufacturers therefore are endeavoring to minimize nitrogen oxide emissions that result during fuel combustion at high temperature and high pressure from the bonding of atmospheric oxygen and nitrogen. AEROSPACE MAGAZIN reports that the Munich Engines and Turbines Union GmbH [Limited], in the context of national and international research programs, is working on new combustion chamber designs that precisely input the fuel supply into the combustion chamber via a dual and fully controllable injection system and should considerably reduce the so-called "hot spots" through controlled swirling.

Additionally, further into the future, combustion chamber designs are supposed to be optimized through the precombustion chamber principle with an expected additional 80-percent reduction in nitrogen oxide emission. A fourth generation propulsion system is being

developed as a joint project by MTU [Motor and Turbine Union, Inc.], Pratt & Whitney and Fiat Avio. The shrouded propfan that, simply put, blends the optimum bypass ratio of the old tried and true propeller drive with modern turbofan technology may realize an amazing bypass ratio of 15 to one with a propeller-like air-blast stage in the turbine shrouding.

Reportedly, this mantle of cold air that is conducted around the core turbine enables a lower specific consumption of fuel of up to 20 percent compared to modern turbofans and a further muffling of the noise at current turbine standards produced by the rapid exhaust.

The high noise carpet at takeoff and landing also has a direct bearing on landing fees. The noise categories from one to three introduced by the International Civil Aviation Organization (ICAO) perceptibly graduate landing fees. It was noted that the 84 dBA [decibel adjusted] contour noise carpet for the takeoff of an Airbus A320 realizes only 90 percent of the permissible values and therefore falls definitely below that of the Boeing 727. The long-haul Airbus A340 undercuts even the most stringent international noise values by 40 percent.

BIOTECHNOLOGY

Genetic R&D at German Cancer Research Center Reported

M12410142794 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 18 Sep 94 pp 7-8

[FBIS Translated Text] A new department at the German Cancer Research Center (DKFZ) is investigating which physical laws determine the three-dimensional structure of the genetic code.

Bends, coils, and loops are arranged in what appears to be a completely random DNA [deoxyribonucleic acid] strand in such a way as to bring particular sections located at a great distance from one another in the sequence into close physical proximity and interaction. These superhelical three-dimensional structures play a crucial role in regulating the activity of many genes, for instance during cell growth and differentiation, and, consequently, in the development of cancer. The members of the new Biophysics of Macromolecules Department intend to find out which physical laws determine the tangled form of the genetic code. Departmental head Prof. Joerg Langowski and his team began their research work at the German Cancer Research Center a few weeks ago.

The scientists are using annular DNA molecules, which are twisted, like strips whose ends have been turned then joined together, as model systems. They build sequences into these rings that give rise to a local bend, or bind proteins into them that bend the DNA. They then observe what changes that this causes in the overall

structure of the molecules. Of course, this cannot be done with the naked eye but requires highly specialized methods. One of these is "dynamic light scattering," in which the DNA rings are exposed to laser radiation. Langowski and his coworkers are able to derive information regarding the internal movements of the DNA molecule from the scattering and the interferences that occur. They obtain further information from various spectroscopic measurements and from what is known as small-angle neutron and X-ray scattering. The two latter-named methods require a neutron reactor and a large particle accelerator, such as those to be found at the Laue-Langevin Institute and the European Synchrotron in Grenoble, where Langowski is allocated time for this work.

The biochemist, now aged 38, has been in contact with these research facilities since 1985, when he began work at the Grenoble branch of the Heidelberg-based European Molecular Biology Laboratory, where he remained until this year.

The second tool that the researchers in the new department are using to discover the structure and dynamics of superhelical DNA is that of model calculations. They have succeeded in quantifying the internal movements of "rings" comprising from 900 to 3,000 base pairs. The computer models can be adjusted by comparing them with experimental data, such as those obtained from dynamic light scattering tests.

Langowski plans to work closely with teams engaged in gene regulation. In the longer term, however, he intends not to restrict himself solely to DNA research: He believes that the aforementioned biophysical methods can be used to obtain important findings concerning other structures as well. Langowski would therefore like to offer his services to other departments at the center, for instance the cytobiology department, where work is under way on the cell skeleton, which also consists of filiform molecules that present a certain dynamic.

Lignin Formation Improved Through Gene Technology

95WS0003C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 28 Sep 94 p 8

[Unattributed Article: "Lignin Formation Improved Through Genetic Engineering—Future Raw Material for Chemical Applications?—Today Frequently a Waste Product"]

[FBIS Translated Text] The goal is to have trees and bushes produce a lot more lignin with the help of genetic engineering. Such plants could be harvested for the first time in 10 to 20 years. After a number of difficulties, the right for commercial use of the related patents has been granted to the British company Zeneca Seed and the French plant growing company Ragt.

Since lignin is considered a future raw material for chemistry it seemed desirable to combine the various ongoing research projects in Belgium, France, Germany, Spain and England, since none of the individual laboratories thought of commercially using the basic knowledge which they gained regarding these basic metabolic processes in plants and trees.

The European Commission (Directorate General XII-D2, JMO B4, L-2920 Luxembourg, Luxembourg) considers patenting of this genetic engineering method as important and promising for the general economy. As a so-called OPLIGE program (Optimization of Lignin in Crop and Industrial Plants) the research activities fell under the ECLAIR [European Collaborative Linkage of Agriculture and Industry Through Research] project of the European Union.

By coordinating the research activities of molecular biology and biochemistry research institutes it was possible to find the structure and functioning of three plant genes which affect the formation of lignin in plants and combine to reduce lignin.

Zeneca will produce tree shoots changed by genetic engineering, and Ragt will concentrate on growing special forage plants for agriculture. Whether trees with a greatly increased lignin content can be used technically, as expected by the OPLIGE program of the EU, is still an open question.

With most of the present processing methods, most of the lignin derived from trees ends up in the waste water of the companies making cellulose and is hardly ever processed further. However, a few laboratories, in particular in the United States, use other methods of making cellulose which would allow the large-scale use of lignin.

DEFENSE R&D

Italy: Delay in Eurofighter Prototype Test Flight
BR2410125794 Paris AIR & COSMOS/AVIATION INTERNATIONAL in French 23 Sep 94 p 19

[Article by Jean Pierre Casamayou: "New Delay for Eurofighter 2000"]

[FBIS Translated Text] The flight of the third DA3 prototype of the Eurofighter 2000 has been put back four months. The Italian prototype, which was supposed to take to the air before the end of the year fitted with E1200 Eurojet engines, will now only get off the ground in March 1995. The four other prototypes will then gradually take to the skies sometime in the course of the year.

The reason for this renewed delay is that there are still problems associated with ironing out the software for electric fly-by-wire control systems, rather than engine problems. Although all the specialists from the four countries are currently working as a joint team in Great Britain, it would seem that the principal difficulty has to

do with the methods of validating the software. Whereas the two first prototypes have made around 15 flights using temporary software granting them a highly limited sphere of flight, the people in charge of the program are waiting for the definitive version of the software before they allow flights to resume. In practice this means that flights will resume once the fly-by-wire control systems have been validated. Indeed, they will resume with the flight of the first two-seater in Great Britain (DA4), which has just undergone a series of 10 days of structural tests, and the flight of the DA5 in Germany. It should be noted that these two prototypes will notably be fitted with ECR90 radar equipment.

While the fly-by-wire control systems are proving difficult to fine tune, the engines on the other hand are proving satisfactory. The two first "flight-approved" EJ200's were fitted to the DA3 prototype that made its first runs this summer at the Alenia test center in Caselle, near Turin. The engine, which delivers 60 kN and 90 kN with afterburning, underwent several cycles of idling with full afterburning, along with reverse thrust tests.

Spain To Launch First Minisatellite for Defense Purposes

BR2010131094 Madrid EL PAIS in Spanish 20 Oct 94 p 36

[Unattributed report: "First Spanish Minisatellite to be Launched with a Rocket from an Aircraft"]

[FBIS Translated Text] Madrid—The National Aerospace Technology Institute (INTA), which is backing the project, announced yesterday that the first Spanish minisatellite will be put into orbit in 1996 using the Pegasus system, a rocket launched from an aircraft in flight. This will be the first satellite launched from Spain and will cost some 1.29 billion pesetas.

INTA, a Defense Ministry body, has signed a contract with the Construcciones Aeronauticas S.A. company worth some 1.3 billion pesetas for the development and construction of the first Spanish minisatellite, the Minisat 01, which will be built with the participation of the Crisa and Inisel space sector companies.

The Pegasus, manufactured by U.S. company Orbital Science, was designed by Spaniard Antonio Elias and has already placed a number of space payloads into orbit, although it recently ran into problems with the launch of two U.S. minisatellites. The minisatellite will be integrated into the Pegasus system at INTA, after the rocket arrives at the Torrejon air base (Madrid) attached to an aircraft.

The Minisat, a program that forms part of the National Plan for Research and Development, weighs 500 kg and can carry scientific, telecommunication and military payloads.

ENERGY, ENVIRONMENT

Germany: Single-Crystal Photovoltaic Cells Developed for Energy Conservation

94WS0530B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Sep 94 p 8

[Article by sel: "Single-Crystal Photovoltaic Cells as Large Modules on the Facade: Demonstration Plant in Juelich Attains Output of More Than 30 Kilowatts—Hydrogen As Energy Reservoir—However, a Long Way To Go To Economic Viability"]

[FBIS translated Text] Aachen. Photovoltaic installations, which have now been put into operation at the demonstration plant of the research center in Juelich and which are to run autonomously, use hydrogen as an energy reservoir. This is a photovoltaic electrolysis fuel cell installation which has been erected for demonstration purposes and for further research. The installation was erected within the framework of the tasks of the Arbeitsgemeinschaft Solar of the state of North-Rhine/Westphalia. The Center for Solar Technology and the Universities of Essen, Duisburg, and Hagen cooperated in setting it up.

Some 321 square meters of photovoltaic surface, single crystal cells as large modules, specially produced for installation on the facade of the building, supply an output of somewhat more than 30 kilowatts due to their various directional orientations. The installation self-sufficiently furnishes a part of the office building with electricity year-round, or at least that is the goal for the next few years. According to calculations, it is necessary for this purpose to direct about a third of the energy produced through the reservoir path of an electrolyzer unit, hydrogen, and fuel cell. About half of the fed-in electric energy comes back out of this reservoir path. The reasons for this are the efficiency levels of the electrolyzer unit, the fuel cell, and the two corresponding d.c. converters, but also the technically limited efficiency of the compressors for the compression of hydrogen and oxygen.

As is the case for all demonstration plants, trade-offs as compared to the theoretical expectations had to be made here too. The planned integration of the bulk of the photovoltaic surface into the facade of the existing building proved to be more expensive than hoped for in terms of costs, material, and time, due to engineering constraints which did not permit the joint use of the existing support structures. The efficiency of the d.c. converters, specially adapted for this installation, also turned out to be lower than expected. This has a not insignificant influence on the energy optimization and operation of the installation.

The fuel cell will prove to be a critical point in this installation. The planned alkali type with about 6 kilowatts is among the first successful developments. Solar

operation levies tough requirements, such as a maximally short switching time in dynamic solar operation, as well as simple servicing and operating safety in the low-temperature range. It is expected that, for the medium term, a fuel cell of the PEM [proton exchange membrane] type can better fulfill this requirement. With about the same efficiency as the alkali cell, it works, however, with a solid electrolyte (membrane) and has the potential to develop to higher current densities and thus achieve a more compact design.

The idea of solar hydrogen operation as a long term option is certainly fascinating. However, a near-term implementation is still a long way off. This is due not only to the multitude of technical problems which still require a long R&D time, but also to the large price gap between the current produced by photovoltaic systems at 2.00 German marks [DM] per kilowatt hour with direct network feed and the known cost of about DM0.30 per kilowatt hour from the electric outlet. Even calculations which include all external costs cannot currently close this gap. This can only be done over the long term through changes in the boundary conditions; although oil will not be scarce worldwide within the next 20 to 30 years, sources such as the North Sea could be depleted by then and the tapping of new sources will be increasingly more expensive.

Photovoltaic installations will also not remain at their current cost level if sufficient efforts in research and development are maintained. Thus, installations which combine photovoltaic current with hydrogen may also get their long term market chances. According to Prof. Dr. Ing. Hermann-Josef Wagner, spokesman for the Arbeitsgemeinschaft Solar and initiator of the demonstration plant Juelich, political efforts have to be made in order to provide sufficient industrial capacity for photovoltaic production and continued research and development.

Germany: Hollow Fiber Module Removes Heavy Metals from Sewage

94WS0530C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 23 Sep 94 p 8

[Article by J.B.: "Hollow Fiber Module Removes Heavy Metal from Sewage: Munich Procedure Is Cost Effective and Highly Efficient—Liquid-Liquid Extraction Used as Basis]

[FBIS Translated Text] *Munich.* Heavy metals in sewage are an environmental problem which causes headaches for the experts. The TU [Technical University] in Munich (Department of Technical Chemistry I, Prof. Dr. Walter Nitsch, Lichtenbergstrasse 4, 85747 Munich) has developed a new procedure which is suitable for the removal of heavy metals from polluted sewage. It is distinguished from conventional procedures by its particularly high efficiency and its relatively low cost.

The system is based on so-called liquid-liquid extraction with the aid of a hollow fiber module. The reaction on

which the separation is based is simple. The heavy metals in the sewage react with complexing agents to form metal complexes that are soluble in organic solvents. If the complexes are then converted into the organic phase, they can then be greatly concentrated. During the subsequent re-extraction steps, the solvent is regenerated. The residue is the metal concentrate which can be recycled. The procedure is characterized by the fact that the sewage and the organic solvent are not mixed but remain separated from each other by a membrane. Substance transfer thus takes place through the membrane. This prevents additional pollution of the sewage by the solvents.

Technically, the system is characterized essentially by the hollow fiber module. It contains hollow polypropylene fibers with an inside diameter of 240 micrometers and a wall thickness of 30 micrometers. The porosity, with an effective pore size of 0.05 micrometer, is 30 percent. The polluted sewage flows through the hollow fiber and the organic solvent in counter flow in the shell of the module. Complex formation takes place at the interface between the two liquids in the membrane pores.

During test runs in Munich, the model pollutant zinc was added to the test sewage at a concentration of 100 ppm (parts per million). This concentration was used to simulate realistic environmental sewage pollution. Even with a single run-through, the water was purified to a zinc concentration of 0.1 ppm. This was clearly below the boundary value for the metallurgical industry of 2 ppm. By increasing the complexing agent concentration, the water could even be purified to the detection limit for zinc. During a second test series, the suitability of the procedure for hydrometallurgical purposes was examined. In this, the main idea was less getting below the detection limit, but rather the maximal concentration of the organic phase for purposes of metal recovery. Water which was polluted with 1,000 ppm could be concentrated to 15 ppm during the flow-through. A lower concentration was not possible as the organic phase was saturated. Thus, the procedure is also of interest for metal recovery.

Compared to conventional extraction and purification procedures, such as the mixer/settler or the column procedure, the Munich system is distinguished by high purification efficiency compared to its size. A hollow fiber module of 50 cm length can replace a 6 m long column for the same output. The reason for this is the large phase surface area of the module due to the hollow fibers. The advantages compared to the fixed-bed ion exchangers are continuous operation, chemical variability due to adapted complexing agents, and high concentration of the metal. All of these properties make the new system economically attractive as well, according to the Munich researchers.

Germany: Hoechst Chemists Develop Material To Destroy Ozone

95WS0016B Berlin *INGENIEUR DIGEST* Oct 94 p 22

[Unattributed article: "Synthetic Destroys Ozone"]

[FBIS Translated Text] Researchers from the chemical conglomerate Hoechst have developed a synthetic material which destroys the irritant gas ozone. The novelty, presented this summer with a great deal of publicity, is called noXon and is said completely to clean ozone from air and water. The irritant gas itself is entirely converted into oxygen. The synthetic material cannot eliminate the reasons for the increased ozone pollution in the summer, however, Hoechst admits. But noXon will help countless people who are suffering from the effects of the irritant.

Experiments by Hoechst researchers produced the result that with the appropriate noXon filters more than 1.5 million times the ozone guideline level of 120 micrograms per cubic meters of air is reliably eliminated without leaving any behind. The developers envision potential applications in hospital air conditioning systems, in schools, office buildings as well as in cars and aircraft, which can be equipped with efficient ozone filters. The synthetic material itself is harmless for users and the environment. Used filter material can be regenerated and reused.

Meanwhile, the company is already working with partner firms on quick conversion of noXon into marketable products. Nearly ready for application is an ozone-zero air filter material, with the aid of which ozone measurements are to be made more reproducible and reliable in the future.

Germany: AVR Research Reactor Promising for Environmental Protection

95WS0013D Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* in German 5 Oct 94 p 8

[Article by Rolf W. Goering: "AVR Research Reactor in Juelich Presently Entombed"; Subheads: "Fuel Elements Stored in Petalite Containers for Time Being"; "Will Site Become 'Green Meadow' Once More?"]

[FBIS Translated Text] Frankfurt—Approval to "entomb" the Juelich Experimental Reactor Team's [AVR] experimental reactor was granted in March of this year. The requisite activities for this have now been initiated. The nuclear reactor was in operation for 21 years and produced electric power. The technical jargon for entombment is "effecting a secure encasement." For nearly a decade this has been deemed to be virtually the simplest solution. In doing so, all movable activated material is first removed. Next, the reactor has to be sealed and constantly monitored for radioactive seepage.

In this way, time is gained for the radioactivity to decay. A decision can then be made whether to leave the reactor

in this condition or whether it can be quite normally disposed of so that a "green meadow" will again sprout on the site. The AVR still has no clear idea of what condition it wants to realize on the site of the operation.

The experimental reactor is immediately adjacent to the site of the Juelich Research Institute [KfA] that also provides the nuclear engineering infrastructure and is provisionally storing the spherically shaped fuel elements. The entombment represents an initial step towards provisionally terminating the promising design and development of an entirely new type of reactor in the fifties and sixties. That type of reactor was the brainchild of Rudolf Schulten, who also brought the pebble-bed reactor to the point of development.

The design's novelty was the use of graphite as a moderator and helium as a coolant instead of water. The nuclear fuel was not enclosed in tubes in the form of pellets that could melt, as exemplified in the incidents at Harrisburg and Chernobyl. Instead, the nuclear fuel was solidly encapsulated in tiny spheres and precisely distributed in the graphite pebbles.

The AVR calculates that secure encasement will be realized in five to six years. One reason for this is that two years will probably be needed even just to remove the fuel elements. There are 100,000 fuel elements in the reactor. Only 50 units each, however, can be drawn off. These are then inserted into canisters each holding 950 units in the KfA Research Institute. Two canisters each fit into the familiar petalite safety containers. In the research institute's provisional storage the graphite fuel elements will find a temporary "resting place" in those special containers.

The AVR contract was signed in 1959. At the time, none of the signatory parties had given thought to the termination of the reactor's operation. The job was rather to demonstrate that such a type of reactor worked and could produce electric power.

On 20 November 1956, nine electric utility companies joined together in the AVR. In 1959 they awarded the BBC [Brown Boveri Corporation] and Friedrich Krupp firms the commission to build the reactor. It cost 82 million German marks [DM] and between 1964-1988 it supplied power into the power grid. The earnings from the power, however, did not cover startup and operating costs.

During the operational period a primary goal was the testing of fuel elements. In 1984, when the pebble-bed reactor in Schmehausen went into operation, the AVR had basically fulfilled its job as a test reactor. The shutdown agreement came about in 1989. In it the Juelich KfA, the federal government and the land pledged to assume the costs of the entombment.

The current activities, however, cannot make use of the dismantlement experiences of water reactors. In water reactors the principal activity arises from the cobalt in

the reactor pressure vessel. The half-life period amounts to six years so that it can be dismantled after 30 years with minimum risk and expense. At the AVR in Juelich, strontium is the key isotope. Its half-life period is close to 25 years. A 30-year waiting period, therefore, is far from sufficient.

Dr. Chrysanth Marnet, technical managing director of the AVR, takes the view that the demolition should not be left for three generations from now. The reactor should be disposed through the collaboration of the experts who operated the reactor and therefore also are aware of where the danger spots are. The established team of 120 experts should still be there and could accompany the dismantlement.

The reactor should be evacuated in the next year and a half. By then the technical and economic deliberations should be concluded and a decision made whether a secular shutdown operation will prevail at the AVR or whether a "green meadow" will cover the site.

EU Appraises Biofuel Option in Fossil Fuel Conservation

95WS0013B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 4 Oct 94 p 10

[Article: "Biofuels: Agricultural Option Deserving Serious Consideration"; Subhead: "Better to Adapt Fuels to Engines, Provisional Assessment of European Community"]

[FBIS Translated Text] Frankfurt—Surplus production of many agricultural products confronts Europe with two options: the "surplus" land could, on the one hand, be planted with forest or, on the other hand, be used for cultivation of grain. Such grain could be turned to industrial account or used for the production of fuel.

The second option offers the advantage of the farmers remaining on their farms and the ability to continue cultivating the land. Whereas in past decades the farmer needed nearly 30 percent of productive land for fodder for his working animals, he presently needs to set aside 10-20 percent for "energy crops" if he wants to supply his fleet of equipment with "bio-" fuels, insofar as they are driven by combustion engines.

These remarks introduce a document by the Agro-Industrial Research Division of the EU [European Union] Commission's XII General Directorate [DG] that constitutes a compendium on the subject of "biofuels" ("Biofuels—Application of Biological Derived Products as Fuels or Additives in Combustion Engines," EC [European Community] Commission, DG XII, Att. Mr. Cornelese, 200 Rue de la Loi, B-1049, Brussels).

There are a number of reasons that recommend consideration of fuels from plants, in the opinion of the Commission, since fossil fuels are likely to become more expensive in the foreseeable future. The EC has an

interest in diversification of agricultural output, including the cultivation of "energy crops." The atmosphere is polluted less by the burning of vegetable oils, since their sulfur content is lower than that of fossil fuels. The emission and consumption of carbon dioxide are kept in balance.

The burning of semi-refined vegetable oils alone or blended with ordinary diesel fuel appears to be possible with no major problems in indirectly injected diesel engines. Tests with the Elsbett engine and an engine developed by Deutz revealed this. The Wankel engine still under development by John Deere has similarly been adapted for this purpose.

Instead of adapting the engines to the biofuels, the fuels should be adapted to the machinery. That would require conversion of the large, branching molecular structures of vegetable oils into smaller molecular chains (transesterification). It would be possible to obtain approximately 1,000 kilograms of methylester from the 3,000 kilograms of rape seed that can be harvested on average from a single hectare. There would also be 1,900 kilograms of valuable, protein-rich animal feed and 110 kilograms of glycerin. Cultivation of rape might lead to a considerable yield of fuel energy, albeit not specifically related to the area under cultivation.

Here is an instance of the balance between energy and mass: 8,650 kilograms of rape are required to obtain 1,279 kilograms of refined oil. If the rape straw is not utilized, 5,470 kilograms of the total biomass remains behind in the field. That is equivalent to nearly half the 156-gigajoule quantity of energy that grows on a single hectare.

With 48.1 gigajoules per hectare, refined rape oil preserves 30.8 percent of that. Comparing the energy preserved in the oil and oil cakes with that expended in extracting it, the resulting numerical ratio is 3.36. Subtracting all the energy consumed until refined rape oil is obtained, the result is an energy yield, when converted, of 864 liters of diesel oil per hectare.

If rape methylester is produced, as a result of the added ethanol an additional energy equivalent of 2.7 gigajoules per hectare has to be factored in. Combining the energies contained in the fuel, the oil cake and the glycerin and comparing them with the total energy expended, a numerical ratio of 2.98 can be computed.

In terms of the fuel itself, that number drops to the value of 1.82. Viewed in an energy optic, according to the conclusion on balance by the EU scientists, rape and sunflower oils and their methylesters are as satisfactory as conventional fuel for diesel engines. Further study is still needed on how they will hold up over the long term.

By comparison, the scientists see no technological advantages in the use of bioethanol as a fuel. Biogas might possibly be of interest for stationary diesel engines

if it is produced through combustion or anaerobic fermentation of biomasses. Still, the engines would have to be modified for that.

For economic and local considerations it has been determined that hardly any biomass fuels can be justifiable alternatives. Over the medium term only tax measures could encourage their use. The environment would benefit from their introduction. Among other things, a general decline in the carbon dioxide content of the atmosphere, a reduction of the greenhouse effect and a slight uptick in the level of nitrogen oxide could be anticipated.

Nearly 172 million hectares in the EU countries are used for the cultivation of grains such as oil and protein-bearing crops, with more than 4.3 million agricultural enterprises dedicated to that. According to the EU publication, considerable land is available for energy crops, for reafforestation and for the production of cellulose-bearing biomass.

ADVANCED MANUFACTURING

ESPRIT Project on Robot Interoperability Discussed

95WS0008A Berlin WT—ZEITSCHRIFT FUER INDUSTRIELLE FERTIGUNG in German
Sep 94 pp 426-429

[Article by F. Mikosch: "Information Exchange with Open Systems in the Area of Robotics"]

[FBIS Translated Text]

Contents

A project group of researchers, manufacturers, and users has been formed in order to facilitate work with industrial robots. For this, among others, standardized interfaces for information exchange and for off-line programming are to be improved. Practical industrial application is demonstrated with industrial robots, which are being used for plasma spraying and for welding of pipes.

1. Introduction

Seven European partners want to develop with InterRob (acronym for the ESPRIT-project No. 6457: Interoperability of Standards for Robotics in CIME [Computer-Integrated Manufacturing and Engineering]) a comprehensive flow of information between product design, simulation, programming, and robot control, with open systems which are based on standards. For this, in addition to neutral representation of product data with the "International Standard for the Exchange of Product Model Data" (STEP, ISO 10303), a standard for robot programming and control, such as "Industrial Robot Language" (IRL, DIN 66312), must be applied. Here, the goal is to facilitate and improve the application

of these standards, as well as to ascertain mutual applicability (interoperability). Communication between the systems is to be expanded by adding information which is important for robots, e.g., information about tools, dynamic behavior, control, and calibration. The exchange of data which are important for robots is to be done not only via neutral files, but also via data banks.

A realistic simulation of robots is to improve the off-line programming of robots. In this process, simulation has to include dynamic behavior as well as robot control.

2. Problem Description

Information technology, and especially robotics, are particularly important aids in reducing costs, increasing product quality, and accelerating of processes, especially product development and manufacturing preparation.

Mass production, e.g., of automobiles is unimaginable today without robots. However, in unit, low-volume, and variant manufacturing, robotics is considerably less common. The reason for this is mainly that, for these types of manufacturing, it is necessary to a much greater extent than in mass production to be able, in today's rapidly developing technology, to replace single components of production information systems with the optimum installation in each case without interfering with the overall process.

Such interchangeable components are, e.g., the CAD [Computer Aided Design] system, the programming system, the simulation system, and the robot with its controls. But these components can only be interchanged without problems if standardized interfaces exist between them. This is being worked on worldwide.

3. Project Group

The development of such standardized interfaces and their application in software are the goal of the ESPRIT [European Strategic Program for Research and Development in Information Technologies] project No. 6457 InterRob: Interoperability of Standards for Robotics in CIME, namely for the STEP and IRL standards (Fig. 1) [not reproduced]. The partners in the InterRob project are the following firms and research institutions:

- BYG Systems, Ltd., simulation systems, Great Britain
- Danmarks Tekniske Universitet, research, Denmark
- Nuclear Research Center Karlsruhe, Inc., research, Germany
- Odense Steel Shipyard, Ltd., user, Denmark
- Reis, Inc., robots, Germany
- Rolls Royce plc, user, Great Britain
- SINTEF, user support, Norway

4. User Requirements

The needs and the requirements of unit and low-volume manufacturers for a comprehensive exchange of information with open systems in the area of robotics is presented in the following, taking the two user firms in the InterRob consortium as examples.

4.1 Plasma Spray Coating At Rolls Royce

Rolls Royce is manufacturing aircraft turbines and is developing new models with higher and higher efficiency. These turbines use less fuel, the higher the temperature at which they may be operated. In recent years, considerable progress has already been made, based on more and more temperature-resistant engineering materials for the rotor and stator blades.

Fig. 2 [not reproduced] shows part of a stator ring in which the side walls have been coated with a ceramic as a heat shield. The coating is applied by plasma spraying. During the plasma spray coating process, the stator blades, which are equipped with holes for cool air, are covered. At first, a very thin adhesive layer is applied by vacuum plasma spraying, and then the relatively thick ceramic layer is applied by air plasma spraying. This layer must be very even and must have the intended thickness in order to avoid even the smallest disturbance of the flow. Such layers can be expected to provide quite considerable progress in turbine technology. Here, the use of robots is ideal because plasma spraying is associated with considerable noise, much dust, intensive UV-radiation, and high temperatures.

Fig. 3 [not reproduced] shows an air plasma spray system with an industrial robot. Over 100 turbine parts are coated in each run in lowest volume production. The problem is that on-line programming is much too time-consuming and frequently shows insufficient accuracy. In the programming of the robot, its dynamic behavior is to be taken into account because the plasma spray gun must be moved at a speed of up to 2.5 m/s. Therefore, the necessary sudden changes of direction cause the robot to run somewhat beyond the desired travel which is to be taken into account during programming in order to obtain layers of sufficient quality. Effective off-line programming considerably shortens production preparation times and increases the productivity and capital utilization of the expensive system.

Programming is done on the basis of a simulation of the entire process in the GRASP system of BYG Systems Ltd. For the simulation, the CAD data of the parts to be coated and the geometric, kinematic, and dynamic data of the robot are used, as well as the process data of the plasma spray procedure. In order to achieve high production quality, there must be sufficient coincidence between reality and simulation. For this, the movements actually carried out by a specific robot in a specific situation must be taken into account in the simulation. The control data must be known, and the robots are to be calibrated because most often robots have very good

repetition accuracy but deviate often considerably from the target path while traveling over a distance.

4.2 Welding of Pipes At the Odense Steel Shipyard

The Odense Steel Shipyard in Denmark is one of the most modern and competitive shipyards in Europe. It owes its outstanding position in shipbuilding to the consistent application of information technology and robotics. In the shipyard there are 29 robots being used, mainly for welding work on the simple, relatively straight parts of the ship's hull. About 40 percent of the ship's hull is produced this way. Much more important than the ship's hull, viewed from the value of the contract, is the pipe system of the huge super tankers.

Fig. 4 [not reproduced] shows part of a CAD model of such a pipe system. Here, the most difficult task is the welding of T-pieces of pipes with different diameters and wall thicknesses. Some of the seams are to be welded several times and in several layers, whereby, in the case of large pipes, the deviation from ideal geometry is to be taken into account. Therefore, also here, good coincidence between simulation and reality is necessary. Realistic simulation is called "model fidelity" for short. Since the welding process is relatively slow, the dynamic behavior of the robot is insignificant; it is possible that the dynamic behavior of the manipulators, which move the heavy pipe parts, needs to be taken into account.

The problem lies not only in the structure of the actual robot welding cell, but also in the embedding of this system into the voluminous CIM [Computer-Integrated Manufacturing] environment of the shipyard: only with complete integration can the rationalization potential be fully realized. Therefore, a database system is being developed which gives uniform access to all product and process information and which permits automatic program generation for specific robot applications. Fig. 5 [not reproduced] shows the system that has been envisioned. It consists of a database which is composed of several partial databases. The system is to be serviced via one uniform user interface. STEP interconnects the systems CATIA, GRASP, ROPSIM. Via IRL programs, robots from Reis as well as [from] two other robot manufacturers are controlled.

5. Proposed Solutions From InterRob

5.1 General

Within the framework of the InterRob project, proposed solutions using open systems are to be presented for a comprehensive information exchange in the area of robotics between the most different systems, from the design, simulation, programming, and administration of manufacturing-specific process data to robot control. Open systems can exchange neutral files via standardized interfaces or are connected via a common database. In this, it is important to improve the interoperability and functionality of the participating standards STEP and IRL.

The InterRob project is developing suggestions as to how, in addition to the geometric data, all necessary kinematic and dynamic data, calibration and control data, can be represented and exchanged in STEP format. This pertains to the continuation of the former ESPRIT projects CAD*I and NIRO, with which essential foundations of STEP were developed. As the robot programming language, the German standard IRL was chosen; it can be assumed that this will become a European standard.

5.2 Development of STEP Processors

Within the framework of InterRob, a series of pre- and post-processors for STEP is being developed. They are to make it possible to exchange data between the different participating systems. It is to be demonstrated that the developed expansions (schemes) are compatible with the overall STEP standard. And the usefulness of these expansions in industrial applications is to be demonstrated. For the seven participating CAD and simulation systems, a total of seven pre-processors and five post-processors with different capabilities are being developed. Table 1 [not reproduced] shows the planned development of STEP processors, whereby the different capabilities of the processors are indicated by the following abbreviations:

- G3: the processor supports the scheme for topologically limited surface models,
- G4: the processor supports the scheme for volume models with faceted face areas,
- K1: the processor supports the basic scheme for kinematics,
- K2: the processor supports the scheme for robot specific data,
- K3: the processor supports the scheme for dynamics information,
- K4: the processor supports the scheme for robot control,
- K5: the processor supports the calibration scheme.

All processors support the scheme for product structure and shape information.

6. Utilization of the Results

The first priority in the selection of the participating systems for product development and production preparation, and the geometric, kinematic, and dynamic capabilities of the processors, is to test and demonstrate the compatibility of the newly developed STEP schemes by exchanging product data between them. Therefore, only some of the developed processors will be developed further into marketable products, and will be marketed, after the conclusion of the project, by those in the project group, mainly BYG and Reis, who offer systems. All

project partners are glad to incorporate their know-how into further product developments, together with interested parties.

6.1 Users Are Being Asked

Development of the product data exchange for geometrical information and standardization in the present form of STEP took over ten years and included the ESPRIT projects CAD*I and CADEX. Industrial acceptance is being promoted at present by a user enterprise initiative, especially in the automobile area. This is the ProSTEP-Club which, starting from Germany, now includes the most important European companies.

It is the goal of the InterRob Project Community to point out to user firms the advantages of comprehensive information exchange with open systems in the area of robotics and to make possible a movement similar to the exchange of geometrical data. Therefore, in addition to the reinforcement and extension of the STEP and IRL standards and the representation in the corresponding standardization agencies, the demonstration of the practical applicability is a primary goal of the project work. The user firms in the project group, OSS and Rolls Royce, will show their applications to the technical audience which is interested in that area; they intend, in addition, to use the results for several important projects in-house. Suppliers of the system in the InterRob project (BYG and Reis) will ascertain, at the end of the project, that the developed open systems will be available in the marketplace. It will be up to the users to pick up these new open solutions for their own benefit.

6.2 Advantages of Simulation Close to Reality

Important interim results can be applied immediately. Thus, Reis will guarantee, based on the better modeling capability of their robots, that a work piece can be worked on equally well everywhere, regardless of the position in the work space of the robot, without having to program. In mirror-image working, e.g., during assembly of automobile doors, only one side has to be programmed. Based on the possibility of completely off-line programming, the down times of assembly lines with several concatenated robots, as an example, can be shortened drastically when changing models.

7. Outlook

Research institutes and application supporters (DTU, KfK, SINTEF), in collaboration with the other partners, will make the InterRob results public and will support their applications. Project partners are cooperating actively in the standardization consortia of STEP and IRL in order to be able to incorporate the project results into the progressing standardization process.

LASERS, SENSORS, OPTICS

Ireland: PEAT Electron Microscope Helps Materials Analysis

95WS0003D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 20 Sep 94 p 8j

[Unattributed Article: "Novel Electron Microscope for Analyzing Coatings—Device Allows Non-Destructive Detection of Microcracks and Provides Precise Chemical Analyses—Passed Its First Tests"]

[FBIS Translated Text] Physicists in the Department for Applied Physics of the Cork Regional Technical College in Ireland have developed a novel microscope which allows the non-destructive detection of defects and microcracks and can carry out precise chemical analyses of these defects. The new instrument is used to improve coatings and check the most efficient adhesion between coating and base.

According to developers Lian McDonnell and Eamonn Cashell three different analysis systems are combined in a single instrument. The expensive and involved development project has been going on since 1980. The developers call their microscope a PEAT microscope (Photo Electron Auger Thermal Wave). With its three main components, it generates pictures from signals which were obtained in completely different ways. The electron microscope can make a detailed photo of a sample to be examined.

The second component of the instrument generates a chopped electron beam which heats the area it hits for a short time and thus generates a thermal wave. The generated wave results in a characteristic sound wave based on the thermoacoustic effect which can be recorded with suitable piezoelectric transducers. By recording this wave, defects in the material composition, microcracks or poorly adhering coatings can be detected. By changing the frequency of the electron beam the image resolution can be changed so that areas of different sizes can be recorded, enlarged or reduced.

Finally, the third instrument component uses a combined ion and electron beam. The ion beam "drills," as it were, a channel through the location in the sample where the defects were discovered. The electron beam excites the electrons of the atoms it hits to such a degree that they will be released as so-called Auger electrons. Based on the detectable kinetic energy of these electrons, individual atoms involved in the defect formation can be identified precisely.

The inventors are considering whether the chopped electron beam could be replaced by laser beams which could also generate detectable sound waves using the photoacoustic effect. No comparison experiments have been carried out yet. However, the instrument passed its first test.

According to estimates by the inventors the instrument can be manufactured commercially now that the work in the laboratory has been completed. The inventors estimate that a total of approximately 50 microscopes are needed in materials research and process technology laboratories. The price is approximately ECU400,000. For further information contact: Cork Regional Technical College, Department for Applied Physics and Instrumentation, Ireland.

Germany: Laser Device Aids Particle Analysis

95WS0013A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 4 Oct 94 p 10

[Article by Peter Winandy]

[FBIS Translated Text] In mechanical process technology, analysis of particle size is an important instrument for quality assurance and process monitoring. Photometric processes in particular are preferred for use here, since they function rapidly and contact-free. The use of diffraction spectroscopy enables the illumination of the collection of particles to be measured with monochromatic laser light, and the diffused light pattern emitted by the particles can be evaluated as a function of the angle of dispersion. At the Institute for Mechanical Process Technology and Environmental Process Technology at the Clausthal-Zellerfeld University (Professor Reiner Weichert (Ph.D., engineering), Leibnitzstr. 19, 38678 Clausthal-Zellerfeld), a diffusion spectrometer has been developed that makes it possible to record the radially symmetric intensities of the diffused light up to an angle of 90 degrees. The particles are illuminated with a small laser diode. The diffused light pattern is recorded by a CCD [charged-coupler device] camera. The center of the diffused light pattern and the intensity can be detected through automated image processing as a function of the angle of dispersion so that there is no need for centering of the detector along the axis of the light beam. As a result of the currently realizable expansion of the detectable angular range it is possible for the lower limits of the measurable range to be unambiguously shifted to less than a micrometer. The photo [not reproduced] shows the addition of material to be sampled in a spherical flask on the diffusion spectrometer.

Germany: Thirty-Kilowatt Welding Laser Developed

95WS0010B Duesseldorf HANDELSBLATT in German 5 Oct 94 p 31

[Article by "hsn" under the rubric "Research and Technology": "LASERS/Thick Sheet Metal Welded. Stimulus for Shipbuilding"]

[FBIS Translated Text] Duesseldorf, Tuesday, 4 Oct 94, Handelsblatt—The Fraunhofer Institute for Laser Technology (ILT) in Aachen has developed together with laser manufacturer Trumpf in Ditzingen a 30-kW high-power laser. The high-integration-level CO₂ laser was introduced at the end of September as an interim result

of the "Third-Generation High-Power Laser" research project, whose objective is to develop new applications for lasers in the treatment of materials.

The new laser is unique in this power class in Europe and is suited for the welding of sheet metal up to 5 cm thick. Lasers of the power class between 6 and 10 kW available on the market till now weld sheet metal in the thickness range of a few millimeters. The high-power laser could provide new stimulus above all to shipbuilding, where today expensive finishing is still required after welding by the conventional method. In addition, surface treatment is possible over larger surfaces with the 30-kW laser.

In the development cooperation arrangement, the Fraunhofer Institute developed the prerequisites for constructing the laser on new physical principles. Trumpf as a laser manufacturer contributed its technological know-how from manufacturing. The company will be responsible for seeing that the new laser becomes a product on the market during next year.

MICROELECTRONICS

German Institute Develops Chip for High Speed Calculations

95WS00118 Duesseldorf *HANDELSBLATT* in German 19 Sep 94 p 32

[FBIS Translated Text] Karlsruhe, 19 Sep—A computer chip for highly accurate scientific computation has been introduced at Karlsruhe University. The university stated that the chip was the only one of its kind in the world. It was developed and produced jointly with the universities of Stuttgart and Hamburg. According to the director of the Institute for Applied Mathematics, Prof. Ulrich Kulisch, the chip makes it possible for the first time to completely exclude inaccuracies which arise in the process of rounding off in traditional computers. In addition, calculations can be carried out using the appropriate software up to 100 times faster.

"This means a huge breakthrough in this area, scientifically speaking," says the head of the institute. The chip, which is only the size of a postage stamp and has 200,000 transistors, was produced by eight engineers and scientists during a two-year project. This had been preceded by 20 years of research at the Institute for Applied Mathematics at Karlsruhe University. It is said to be possible to incorporate the so-called "vector arithmetic coprocessor" into any commercially available personal computer.

Pan-European JESSI Program Helps Semiconductor Industry 'Catch Up'

AU1910201194 Zurich *NEUE ZUERCHER ZEITUNG* in German 16-17 Oct 94 p 13

["fb."-attributed report: "Europe's Semiconductor Industry Is Catching Up"]

[FBIS Translated Text] Grenoble, 14 October—Owing to their "JESSI" project (Joint European Submicron

Silicon Initiative), which was founded in 1989, Europe's semiconductor producers, led by Siemens, Philips, and SGS-Thomson, have caught up considerably in technological terms with their competitors in Japan and the United States. Nonetheless, this promising sector still has a relatively weak foundation.

The JESSI cooperation and research project, which was created by the European semiconductor industry in 1989 and, in the framework of the EUREKA [European Research Coordination Agency] technology program, is being subsidized by Brussels until 1996 with ECU450 million annually, has proved to be a success. Europe's semiconductor producers have thereby largely overcome the technological gap to their U.S. and Japanese competitors and are currently operating with a profit again. Therefore, it is absolutely necessary to continue this initiative, which was limited to a period of eight years, until after 1996, since Europe's semiconductor industry is still isolated on international markets, and the Old World still depends too strongly on the United States, Japan, and Korea. In addition, the competitors, particularly in Korea, receive massive governmental subsidies. This, briefly, is the message that Europe's semiconductor industry propagated at a symposium on the future of microelectronics in the Old World, held in the French university city of Grenoble recently under the title "JESSI and What Then?"

Respectable Again

The symposium was held at a favorable moment. The European semiconductor industry is currently having two-digit sales increases and almost equally rapid profit increases. Owing to unexpectedly good business, the Italian-French joint venture SGS-Thomson, which opened a highly modern semiconductor plant last year in Crolles, several kilometers from Grenoble, is already sounding the attack on the leading market player Intel—a plan that would have been absolutely inconceivable in the past. The market prospects also continue to be considered favorable. The strong demand for mobile telephones worldwide has pushed up the demand for "chips" so rapidly that producers can hardly keep up. A semiconductor plant set up by Siemens in Singapore has been working almost around the clock for weeks.

In addition, European producers have also largely overcome their technological lag behind their international competitors—which to a high degree is attributable to JESSI, as they say themselves. Whereas in 1989 they lagged at least three years behind, they now lag only several months behind their competitors in the United States and Asia. This success shows that the research effort made within the framework of JESSI and comprising as many as approximately 3,000 man-years was not in vain. Since 1989, approximately 150 companies in 14 European countries have taken part in JESSI through 70 joint ventures. The latest technological breakthrough was reported by SGS-Thomson and Bull recently. These concerns have succeeded for the first time in equipping a

CISC (Complex Instruction Set Computer) microprocessor with 5 million transistors. With this innovation, they developed one of the most efficient microprocessors ever, they say.

The technological progress made within the framework of JESSI has also increased the prestige and attractiveness of the European semiconductor industry. At the end of the 80's, this sector was seriously in danger of totally dropping out technologically and economically. Since then, many alliances with non-European semiconductor firms, such as cooperation agreements between Siemens and IBM, or SGS-Thomson and Mitsubishi, and the partnership between Philips and IBM, reflect the change. Without JESSI, the successful cooperation between Philips and SGS-Thomson would never have come about so soon, it was said in Grenoble.

A Long Way

Despite such praise, the continuing problems of European producers in general and the JESSI project in particular were not swept under the rug in Grenoble. The mere fact that the sales increase of the European producers by an average 15 percent last year lagged far behind the 28-percent expansion of the international semiconductor market must give rise to serious concern. If the European producers are unable, in the current phase of expansion, to increase their share in the world market, which is still marginal, they will probably have problems in surviving the next slump on the semiconductor market, which is known for its changing cycles. International competitors still consider Europe to be an outsider that they do not have to fear for a long time to come.

For their part, the European producers deplore, above all, the fact that the Old World does not have a common strategy for the user areas that are of current interest and very important for the semiconductor branch, such as the establishment of a "communication highway" or the introduction of "intelligent" credit cards throughout Europe. Even the abolition of the telecommunications monopolies is only making slow progress in the European countries. However, as long as Europe does not agree on a continental approach to these projects, the European semiconductor industry will not have a sufficiently large domestic market, industrialists say. In Grenoble, they criticized political obstacles—above all those of the British Government, which actively promoted the establishment of subsidiaries of Japanese and U.S. competitors in the United Kingdom, but was not concerned about the survival of the European industry. According to JESSI statistics regarding the European demand for semiconductors, less than one-third is met by European suppliers, whereas the Japanese cover 86 percent, and the Americans cover 69 percent of their domestic market.

Thus Europe's semiconductor producers not only had to catch up in the technological area, they now also have to hunt for new markets inside and outside Europe. The

symposium in Grenoble showed that the European microelectronics industry is well aware that the stretch of road that has yet to be covered is long, but the time left is short. To be able to face the new challenges better, producers demand that industrial cooperation agreed upon within the framework of JESSI will have to change in the future. Less horizontal cooperation, more centralization of applied research, and fewer political compromises regarding the allocation of funds—these are the most important demands of those involved.

Several company representatives even created the impression that, from a technical viewpoint, they do not need another JESSI; what they do need, however, are state subsidies. The industrialists meeting in Grenoble demonstrated solidarity in view of the fact that they will have to fight before they can expect to receive subsidies from Brussels. Out of regard for the European governments that are still undecided, they did not mention the concept of a JESSI successor project that they have already in their drawers. The project is reportedly called Medea.

SUPERCONDUCTIVITY

German Research in Superconductor Applications Detailed

Government Research Support

95WS0005A Duesseldorf *HANDELSBLATT* in German
28 Sep 94 p 25

[Article by nl: "Heinz Riesenhuber Blazed the Trail"; "BMFT/New Support Concept for Superconductors"; first paragraph is introductory]

[FBIS Translated Text] **Federal Research Minister Paul Kruger wants to help the Federal Republic of Germany keep pace in an important high-tech area—high-temperature superconductivity. In this respect, he can build on the farsightedness of his office predecessor, Heinz Riesenhuber.**

The Parliamentary Undersecretary in the Federal Ministry for Research and Technology (BMFT) is Bernd Neumann. He now summarized the results for the previous support of high-temperature superconductivity and introduced new lead projects.

High-temperature superconductivity has blossomed rapidly as an important technology of the future. Materials were discovered in 1986 that do not lose their electrical resistance just at an extremely low temperature near absolute zero such as the temperature of expensive liquid helium. These materials are also able to transport current without losses. Since their discovery, the world has been searching for additional high-temperature superconducting materials and applications.

The BMFT, then led by Heinz Riesenhuber, did not miss out on its opportunity with the discovery that was

awarded a Nobel Prize, and quickly started a new support program. The Ministry also felt that it had to make up for something. About ten years before, its experts had flatly refused a request for support for the development of high-temperature superconducting materials as "completely futile."

In the opinion of Bernd Neumann, the trouble was worth it. Seven years after the first compounds were found that can be cooled to the necessary temperature with liquid nitrogen at a lower cost, the first product has reached the market and others are to be introduced shortly. Besides Japan and the U.S., Germany holds a leading position in basic research. This applies particularly to superconducting quantum interference devices (SQUIDS). These are tiny, very sensitive measuring heads that can measure even the smallest magnetic fields and changes and have a broad range of applications.

However, Germany can only maintain its position if further development is oriented toward concrete applications. "Record results on laboratory samples are of little use if they are not converted to engineering dimensions." Primarily in the area of electrical energy and SQUID application, for this reason, substantial lead projects and lines of development are foreseen for additional support by the BMFT. The research infrastructure created by the support up to now, including universities, large-scale research facilities, and companies, offers the best prerequisites for the execution of these projects.

Focus on Cables and Short-Circuiting Switches

Consequently, superconducting power cables are to be developed that, for example, can replace the underground copper cables existing in large cities today when, one day, the demand for power increases ("without having to tear up the streets to do this," says Undersecretary Neumann, confidently). At the same time, current limiters of the future, made of superconducting material, should respond to short circuits in the high-power networks much faster than conventional fuses, keep damage to a minimum, and save expenses in new installations.

Both lead projects are among the largest support plans of the BMFT in the area of high-temperature superconductivity. The first project has just been approved, and each will be funded at about 20 million German marks [DM] for the next three years. They are to be implemented in close cooperation with future users.

A similar situation applies to the SQUIDS developed in particular at the Nuclear Research Center of Juelich (KFA). These devices can be used to measure heart and brain currents with maximum sensitivity, to find mineral resources and waste sites, and to detect material defects and aging symptoms in materials earlier than previously. The construction of devices is of interest for small and medium-sized companies that often lack the required capital.

Undersecretary Neumann sees new paths to overcome the innovation hurdles in the innovation program for

young technology companies of the Reconstruction Loan Corporation (KfW), recently started by the federal government. This program permits companies to obtain low-interest loans from the Reconstruction Loan Corporation for the long-term financing of research and development plans and the commercial conversion of such plans. In this case, it should be especially emphasized that the courage to accept the innovation risk is rewarded by partial release from liability of the transmitting borrower's bank.

The BMFT has accepted the projections that the marketing potential worldwide for devices based on high-temperature superconductivity will increase explosively. In 1993, this market was at about DM4 to DM5 billion and was almost exclusively represented by the helium-cooled low-temperature superconductors used in nuclear magnetic resonance equipment. However, according to estimates of the International Superconductivity Industry Summit (ISIS) in May of this year, this market by the year 2020 should be DM150-200 billion with a large range of products.

Applications Totalling DM460 Million

Until today, the BMFT has invested support funds totalling DM260 million into the new technology or earmarked for research and development in this area. To this are added about DM200 million from basic funding of large-scale research facilities that play an important role in the development of this technology. A new support concept for the years 1995 to 1999 is being prepared by the BMFT at this time and should be published this autumn.

Electricity Storage Research

95WS0005B Dueseldorf *HANDELSBLATT* in German
28 Sep 94 p 25

[Article by nl: "Conquering Power Quantities"]

[FBIS Translated Text] The storage of power is a problem that has not been satisfactorily solved technically for many applications. Superconducting magnetic energy storage (SMES) devices are suited in principle to store very large quantities of power at low losses and to supply this power again on short notice when needed. In particular, the use of SMES devices in power stations to handle a suddenly occurring peak demand within seconds should be worked out within the framework of a feasibility study funded by the BMFT. The BMFT is making available DM1.68 million until February 1996. The beneficiaries are the utility companies Preussen-Elektra AG, RWE Energie AG, as well as Siemens AG. Research projects, particularly in Japan and the U.S., are aimed at introducing SMES devices with medium energy capacity into practice by the end of the century. A preliminary study of the BMFT showed that a SMES device with about 100 MW power and an energy capacity of 2 MWh could be a worthwhile size.

Current Limiters Research

95WS0005C Duesseldorf *HANDELSBLATT* in German
28 Sep 94 p 24

[Article by nl: "More Safety in the Power Grid"]

[Text] To prevent damage to power distribution systems caused by short-circuit currents, researchers at the AEG Research Institute of Daimler-Benz AG in Frankfurt are developing transformers using high-temperature superconductors. Short-circuit currents in the low-voltage, medium-voltage and high-voltage systems of power distribution networks may reach 100,000 amperes and more, and develop catastrophic destructive force. For this reason, the interest of power system builders in devices that reliably limit currents in the event of a short circuit is great. Until now, inductors or current-limiting fuses were used for this purpose. However, inductors cause an undesirably large voltage drop under nominal conditions and fuses must be replaced after each use.

With ceramic high-temperature superconductors (HTSL), current limiters should become economically feasible. With HTSL such as yttrium-barium-copper oxide, liquid nitrogen is adequate for cooling instead of the expensive helium used for low-temperature superconductivity.

In the AEG Research Institute, the first laboratory models have been created. The basic principle is that the current of the system to be protected flows in the primary winding of a transformer. The secondary winding, a solid HTSL ring, is in the superconducting state during normal operation. It has no electrical resistance and compensates the magnetic field of the primary winding almost completely. During normal operation, the transformer allows the current to pass virtually unhindered. In the event of a short circuit, on the other hand, the current of the primary circuit increases—as does that of the secondary circuit—to a very high degree. In the HTSL ring, the current becomes so large that superconductivity breaks down. It places an electrical resistance suddenly in the path of the current. Within a few thousandths of a second, this allows the resistance of the transformer to increase by many times.

Even after such a short time, the transformer limits the short-circuit current. This is sufficient to protect parts of the system. Once the current again drops below the critical value of the high-temperature superconductor, this conductor returns to its superconducting operating state.

The researchers are now developing special melt methods to manufacture HTSL rings and hollow cylinders. Until now, no wires made of superconducting ceramics have been available that can carry the required currents.

TELECOMMUNICATIONS**West European Telecommunications To Be Improved with Swedish-German Undersea Cable**

95WS0003A Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* in German 26 Sep 94 p 10

[Unattributed Article: "Cable Through the Baltic Sea"]

[FBIS Translated Text] The world's longest and most powerful high voltage d.c. sea cable is currently being installed in the Baltic Sea between Herrenwyk near Luebeck and Kruseberg near Malmoe, Sweden. The 250-km-long cable is to be operational before the end of the year. This "Baltic Cable" supplies 600 megawatt, has an operating d.c. voltage of 450 kilowatt and a 1333 ampere current. The cable was ordered and is operated by "Baltic Cable", a subsidiary of Preussen-Elektra and the affiliated Swedish companies Vattenfall and Sydkraft. The installation allows the bidirectional exchange of power between the West European combined network UCPTE and the Scandinavian combined network NORDEL. The Swedish hydroelectric power can be used in Northern Germany, and Preussen-Elektra AG is able to supply power from fossil-fueled or nuclear steam generating power plants to Sweden. Power can be supplied in a highly efficient manner, and part of the peak demand can be met without costly additional power plants.

France: Gerard Thery Proposal on Information Superhighway Presented**General Outline**

95WS0019A Paris *LE MONDE* in French 24 Oct 94 p 12

[Article by Yves Mamou: "Thery Report Handed Over to Prime Minister; Connecting the French to the Information Superhighways Within 20 Years"]

[FBIS Translated Text] "We should not wait." The phrase recurs like a refrain throughout the report that Gerard Thery, the former general director of telecommunications and inventor of the Minitel [French videotex terminal], handed over to Edouard Balladur a few weeks ago. Gerard Thery, the man who equipped France with a modern telephone network, also wanted France Telecom to engage immediately into what he views as the major battle of the 21st century: information superhighways.

A report was therefore ready, which should not wait. But it had to wait, first to allow Edouard Balladur to take time for reflection. Then, it had to wait until the uncertainties resulting from the Longuet case were removed by the industry minister's resignation; and until Mr. Longuet's successor, Mr. Jose Rossi, had read the report. And, finally, the report had to wait until conflicts originating at the top level of the State apparatus concerning the concept of information were settled. Actually, the report could not fail to get bogged down between Nicolas Sarkozy, the minister of communication and budget,

This report may contain copyrighted material. Copying and dissemination is prohibited without permission of the copyright owners.

who wanted control over the dossier, and the Ministry of Industry, which did not want to relinquish it; between France Telecom, which wanted no part of that plan of action, and Marcel Roulet, the Telecoms general director, who feared for his job; and between the various candidates to the succession of the latter (Jean-Bernard Levy, Gerard Longuet's former chief of staff and currently advisor to Jose Rossi, or Didier Lombard, currently general director of industry). To such an extent that some, well- or ill-intentioned, began to arrange for leaks. To accelerate the process? Or to interrupt it?

The Main Proposals

To remain in the race against the Americans, Japanese, and Germans, who have started a massive-investment policy, Gerard Thery and his staff propose two objectives to the government:

- to connect all French households and businesses to information superhighways by 2015;
- to promote "equal access of all citizens to information superhighways." To prevent any permanent break between rich and poor, between towns and rural areas, between businesses and private individuals, the Thery report recommends equal connection opportunities for all.

This dual objective presupposes a four-part plan of action:

- massive development of fiber-optic connections, the first objective being to equip 4 to 5 million households and businesses "within a reasonable time";
- creation of experimental platforms in Paris and in the region to test new services and software. This to prevent some questions from being raised, such as: should we wait until the entire country is connected through fiber-optic cables before creating new services? Or: Can we encourage businesses to invest in services without offering them a market and infrastructures?—the Thery report recommends "a particularly integrated technical strategy";
- software development. Because information superhighways cannot operate without software capable of dispatching information from one point of the network to another, the Thery report recommends considering a system similar to the one used in Silicon Valley, California: venture-capital organizations ready to finance new software packages and services;
- general use of ATM (Asynchronous Transfer Mode). This revolutionary switching technique developed by the National Center for Telecommunications Studies (CNET), a subsidiary of French Telecom, enables any user to connect immediately to any service (television channel, library, database, or videogame base, etc.).

ATM can interconnect all existing (business and public) networks, and it can handle very high data throughputs.

Accessibility Issues

95WS0019B Paris LE MONDE in French 24 Oct 94 p 12

[Article by Yves Mamou: "'To Provide Universal Access to Knowledge'"]

[FBIS Translated Text] Like any major project, information superhighways give rise to the maddest dreams. The Thery report is no exception: information superhighways are supposed "to provide universal access to knowledge." Libraries will become accessible to all without having to go there, through household or business terminals; French and foreign databases will become easy to consult; and the fantasy of a removal of all obstacles between the general public and existing "huge knowledge storehouses" will take shape.

What is at stake may be cultural, but information superhighways are more certain to be a powerful factor of economic change for the service industry: remote medical treatment, television teaching, working and banking at home, etc. "Businesses will use the superhighways as information carriers between them and their suppliers for just-in-time manufacturing, between them and consumers for product marketing, and, internally, to help achieve total quality through team work. In the next few years, therefore, information superhighways will become one of the most powerful levers of the economy."

Among the services likely to experience the greatest changes, the Thery report mentions government departments. When it comes to taxes, social security, or identity papers, to name a few examples, all citizens should be able to have quick and direct access to all files that concern them.

Banks and insurance companies, too, are on the front line: home banking, financial or insurance products at home, etc.; all these services will become available, for consultation or purchase, without having to go there. As for remote transactions, technology already makes them possible, with full security. All services designed to help the elderly and enable them to remain at home should also experience spectacular growth. Finally, we can imagine that some day, thanks to virtual-image technology, museums will be open to visitors who will stay at home, in front of their screens.

Even before these dreams materialize on multiple screens, information superhighways should make it possible to create jobs: 300,000 according to Gerard Thery, who advocates a policy of massive investments. And in the still nearer future, they can safely be expected to constitute one of the obligatory themes in the presidential campaign.

Existing Components

95WS0019C Paris LE MONDE in French 24 Oct 94 p 12

[Article by Yves Mamou: "What Is To Become of Existing Circuits?"]

[FBIS Translated Text] Will information superhighways unify existing networks or replace them? Should we tear down everything to build something new? Or should we knit together different types of cable networks?

Today, the telephone network comprises three different components:

- telephone exchanges equipped with digital switches;
- optical fiber linking all these toll switching systems;
- copper wires to connect subscribers to the network.

This telephone network is adequate to carry vocal communications and all so-called low-throughput services (i.e., with a low number of binary data per second), such as fax and Minitel. But the entire copper-connection section is becoming inadequate for multimedia exchanges. It is that section that must be modified (see diagram [not reproduced]).

Cable networks are television-program distribution networks. A cable network consists of:

- one "network headend" which receives the channels, from satellites in most cases, and rebroadcasts them via cable;
- one fiber-optic network connecting the network headend to distribution centers serving 1,000 to 10,000 households;
- a coaxial-cable connection network serving each household. This final section is the bottleneck in the communication chain. Coaxial cables have a low throughput and do not allow for the return flow of digital data. If cable networks want to become part of information superhighways, they must invest in optical fiber.

The radiotelephone network consists of mobile telephone sets (portable or car phones) connected to a set of terminals via radio waves. The terminals are both connected to one another and connected to the public telephone network. Information superhighways can increase the number of radio terminals and expand the range available to users of mobile communication devices. There is one problem, though: radio links are low-throughput links which preclude the use of the radiotelephone network to transmit images.

The radio network. Massively used by public and commercial channels, the radio network is now reaching its saturation point. The frequency spectrum is no longer adequate to add one or several more television channels. The network has one drawback: it does not provide any interactivity.

Satellites. A satellite is like "a one-way information superhighway." With digital compression, it is possible

to have a nearly infinite number of television channels, but no interactive service can be offered. A clear political will to privilege information superhighways will have an impact on the satellite investments of communication groups.

Role of France Telecom

95WS0019D Paris LE MONDE in French 24 Oct 94 p 12

[Article by Yves Mamou: "France Telecom on the Front Line"]

[FBIS Translated Text] France Telecom could probably have managed without the recommendations of Gerard Thery, who believes (and writes) that "France Telecom's participation in the deployment of information superhighways is one of the essential conditions to achieve the overall objectives commensurate with the country's ambitions." And he asks for "a major strategic move" on the part of the public telecommunication operator.

Strategic move. These words sound rather unpleasant to France Telecom's ears. The operator has other commitments. On 1 January 1998, existing monopolies on telephone services will be abolished. Individuals, and above all businesses, will be in a position to look for competitive pricing.

Entirely absorbed by the preparation of this first "Big Bang," the public operator is patiently forming alliances, attempting to modify its status, reforming its tariff schedule, and trying to reduce its debt. Simultaneously, there is increasing pressure in Brussels as well as in France to abolish the monopoly on infrastructures—which, for instance, prevents the Lyons Water Company and the General Water Company from using their cable networks to offer telephone links.

Prudence and Skepticism

France Telecom knows that its years of prosperity are over and that it will have to fight hard; the government, therefore, expects to see its margins shrink, and these forecasts are the cause of its great financial prudence, even its skepticism, toward major projects; which prudence and skepticism are fueled by the failure of the cable plan.

Last spring, the telephone operator thus presented its network modernization plans. It then planned to replace copper cables with fiber optic cables in the headend—i.e., between switches—without altering the tail-end (connections between switches and subscribers). At the time, the investment was estimated at 20-25 billion [French] francs per year. At the time, France Telecom felt there was no pressing need to equip the tail-end.

Should it clarify its outlook on services and software before taking the major technological leap or, on the contrary, should it bet on the driving force of optical fiber? The two reasonings clash, and the telecommunications world is divided. "The all-fiber-optic networks

are the best bet in the intermediate term," people at Alcatel explain, who thus hope to consolidate their knowhow. Others view Gerard Thery's ambition as a Pharaonic illusion. "The all-digital, all-fiber-optic networks that they are trying to impose on France Telecom is a purely technological credo. It has no economic basis. It is very much like the all-electric all-nuclear plan of EDF's [French Power Company] heyday. It is like asking Air France to buy a fleet of Concorde right when the airlines are fighting it out!" an expert pointed out.

Reconciling a logic of public service and a major technological project—to guarantee connection and equal access to all subscribers—with the necessary adaptation of France Telecom to a world where all regulation barriers are about to collapse, that is truly a headache. Looking ahead to 1998, should France Telecom be encouraged to follow its present course, which is essentially one of management? Or, on the contrary, should we, like Gerard Thery, believe that it is in the operator's best interest to overinvest between now and 1998 in order to face deregulation with the competitive lead provided by optical fiber? It is now up to the supervising ministry to decide. If it really wishes to do so.

[Box, p 12]

Fixed Fiber-Optic Networks

Information superhighways are at the same time fiber-optic networks, digitized information, and superpowerful software ensuring information flow from one point of the network to another.

The term "information superhighways" refers to fixed fiber-optic networks that carry all imaginable communication "signals"—voice, texts, movies, graphics, videogames, etc.—from any point of the country (or, ultimately, the planet) to any other point. One important consideration is that these vehicles or signals can travel only after being translated into digital language. Fiber optics is the only technology that allows very high data throughput rates (4 to 5 megabits for digitized and compressed television images). A single fiber-optic pair can carry as much data as 50,000 telephone lines, in both directions.

Fiber optics and digitization have the advantage of unifying all communication systems: telephone exchanges (voice, fax, etc.) and television images will no longer go through separate channels. A single wall outlet in an office or apartment will connect a lot of different devices and functions (television, telephone-videophone, microcomputer, fax, radio, game console, etc.) to a single fiber-optic network. New functions, such as videophone (picture telephone), will become more common.

For Gerard Thery, information superhighways also mean multimedia, i.e., a series of interactive services using digital media to receive and send information under all its forms (sound, animated, fixed, or virtual images, etc.). All the information stored on CD-ROMs, which is used in closed circuit on microcomputers, will also become accessible through databases connected to the network.

Why is it that information superhighways have become a current theme at the same time in Europe, the United States, and Asia? Because of three simultaneous technical breaks:

1. Digital image compression. Digitizing an animated image (television or cinema) generates such a large quantity of figures that the sheer volume prevented them from being broadcast. To broadcast films or televised serials, this huge bubble of figures had to be compressed. Thanks to complex algorithms and to the development of electronic components that make them work, compressed digital images are about to supplant analog images.
2. ATM (Asynchronous Transfer Mode). The latest innovation in telephone switching, ATM makes it possible to manage simultaneously digital flows of all kinds (voice, images, sounds, etc.) with throughputs that can vary on demand, and to guarantee data-flow continuity with acceptable delays.
3. Optical fiber. This material, which is now manufactured industrially, makes it possible to convey huge volumes of data without any data loss.

BIOTECHNOLOGY

Mexican Biotechnology Institute Research Profiled

95WS0009A Mexico City LA JORNADA (R&D September Supplement) in Spanish 12 Sep 94 pp 1, 5

[Article by Patricia Lopez Suarez: "UNAM's Institute of Biotechnology"]

[FBIS Translated Text] Intimate codes that reveal our secrets, from species to intelligence, from race to susceptibility. From seeming colors to true shadings, from dysfunctions to efficacies. More than 100,000 codes in each of us, with their exact messages that are beginning to be deciphered through the astonishing language of a revolutionary science: biotechnology.

Almost science fiction for those not versed in it, biotechnology is a solidly and broadly based multidisciplinary study of all that lives, in which its interpreters use biochemistry and engineering, medicine and veterinary medicine, in search of the answers to these codes that reveal what we are: our genes.

Today, these answers are being sought in Mexico at a level of excellence, through the diligent work of the Biotechnological Institute [IB] of the National Autonomous University of Mexico [UNAM], a pioneer of this branch of science in our country and in Latin America.

Modern Biotechnology

"Biotechnology came into being with the human being, who since the distant past has used living systems and their parts to satisfy his health, food, and industrial needs, modify his environment, and improve his quality of life," said Dr. Francisco Bolivar Zapata in the course of an interview. Dr. Bolivar Zapata is the director of UNAM's IB. The discovery of genetic material in 1953, he said, ushered in modern biotechnology, which makes possible the clear and molecular imaging of the functioning of live cells and the structure of genetic material.

Enzymatic manipulation of the hereditary material of living beings began in 1970, and with it the technology known as genetic engineering, that is, the fundamental biotechnological technique for isolating, managing, and utilizing the genetic material of almost all living beings.

As a member of the world's first research team to succeed in introducing a human gene into a bacterium, Francisco Bolivar Zapata was pursuing a post-doctorate course in 1976 at the University of California at San Francisco when his research group, headed by Dr. James D. Watson, winner of the Nobel Prize in 1960 for his discovery of the structure of deoxyribonucleic acid (DNA), achieved this milestone marking the inception of modern biotechnology.

The birth of this multidisciplinary science marked the start of responses to questions as to what the genetic material of microorganisms, plants, and animals is like,

how DNA duplicates itself and transmits itself to subsequent cellular generations, and how the structure of genes and chromosomes has changed during evolution.

Research at the Frontiers of Knowledge

In 1982, the CIIGB [Biotechnology and Genetic Engineering Research Center], the first group of its kind in Latin America, was created at UNAM. Its staff consisted at the time of nine restless Mexican researchers, who breached a wall in our country, with one goal in mind: to develop biotechnology integrally and cross-disciplinarily at UNAM, based on cutting-edge research at a level of academic excellence and on the training of specialized human resources.

In 1991, the Center was converted into the Institute of Biotechnology with residence in Cuernavaca, Morelos. Today, the IB has 63 researchers, 45 academic technicians, and more than 140 students, of whom 120 are postgraduates including approximately 40 PhD's. The IB has three principal functions:

- a) The conduct of research and generation of knowledge in molecular biology, cellular biology, microbiology, biochemistry, biochemical energy, immunology, structural biology, and microbial ecology, among other areas.
- b) Utilization of knowledge in biology to develop competitive biological technology, preferably in collaboration with the industrial sector, oriented on the solution of problems in areas of health, farming and cattle-raising, industry, and treatment of environmental contamination.
- c) Participation in the training and development of human resources, through multidisciplinary projects, together with UNAM and other universities.

In Quest of Our Genetic Map

The grail of biotechnology is the "modification" of some genes having "hereditary defects." The biotechnological revolution has led to the creation of synthetic human insulin, tomatoes that are more resistant to drought, the use of bacteria to treat sewage, and many other applications. "Reading" the genetic material of plants and animals means deciphering the coded language by way of which researchers can recognize, interpret, and modify hereditary characteristics.

"We humans have 100,000 genes in 23 pairs of chromosomes," says Dr. Francisco Bolivar, referring to the Human Genome Project, a worldwide objective of the biotechnologists, the aim of which is to know the position, structure, and scope of those 100,000 genes. "It is like working with a vast cassette full of genetic information that we are trying to retrieve.

"It is an effort to map our genetic make-up, to know ourselves, since to modify we must know all about how we are constructed. Of those 100,000 genes, we currently know only some 5,000, and some 40 years from now we

may be able to complete the map," Dr. Bolivar adds, speaking of this joint research effort. It involves a vast academic interchange with universities and research centers at the frontiers of knowledge throughout the world.

Genetic Therapy

With tools like the human genome map and genetic engineering techniques, the potential exists for modifying dysfunctions through genetic therapy, the possibility, that is, of curing genetic diseases by introducing an external gene into an organism whose own gene is failing to perform its normal function.

Genetic therapy is a reality that has succeeded in correcting high levels of cholesterol in the blood, for example, and in bringing into a less-isolated living environment the "bubble baby" who had grown in a sterilized medium because of genetic deficiencies in its immunological system.

Biotechnologists are on the trail of weapons for use against cancer, AIDS, and Down's syndrome, and of tools for lengthening the average human life span, restoring ecosystems, and creating new technologies enabling industry build without destroying.

Industrial Front

The broad field of biotechnology has centered more than half of its responses to the country's problems on those in the medical and pharmaceutical area, but it is advancing in agriculture, nutrition, and care of the environment.

Currently, UNAM's Institute of Biotechnology has 45 collaboration agreements with private-sector and state-controlled industries. Forty percent of these are foreign companies, "because Mexican industry is still in need of a change of mentality. It does not have a research tradition. It does not venture forth," says Dr. Bolivar Zapata, who regards the lack of economic stability as one of the factors that deters industrialists from investing in scientific research.

"The government must attract industrialists to research, through tax incentives. Up to 50 percent of what they invest could be paid for in this way, as is done in other countries," says Dr. Bolivar.

Companies such as Syntex, Lightnin, Bacardi, Abbot, Cigarros La Tabacalera, Schering, Genencor, and Ciba Geigy, among others, as well as state-controlled companies such as Pemex, the Mexican Petroleum Institute, and the Electrical Research Institute, are already working with 12 new technologies created by UNAM's Institute of Biotechnology. The Institute has an annual budget of \$12 million, provided to it by UNAM, CONACYT [National Council for Science and Technology], and various national and international grants which the researchers themselves seek out.

Science Fiction: A Twilight Zone

Extracting the genes of a living being to implant them in another is somewhat like editing a piece of music out of one cassette and into a different one. This is how Francisco Bolivar Zapata explains biotechnology: an orchestra in which academic excellence converts chemists, biologists, and physicians into biotechnologists, into "editors" of those tapes, which, instead of melodies, contain secret codes, the genes that define us.

Eliminating organic dysfunctions, developing fortified plants and productive viruses. It sounds like science fiction, about which the director of UNAM's Institute of Biotechnology says: "Science fiction is scenarios in which the possibility of an event is assumed, without any scientific basis whatever. Just 30 years ago, transferring a human gene to a bacterium was science fiction. Today, we have succeeded in doing it. As science advances, science fiction scenarios lose their science fiction settings. There is a continuum, a twilight zone."

With the twilight zone before our eyes, like a mist that at any moment disperses, Francisco Bolivar holds science in one hand and fantasy in the other: "I dream of there being an ever clearer awareness on the part of society of these biotechnological tools that enable social improvements. It is an ideal that there no longer be children with Down's syndrome, that the average life span be lengthened so as to lengthen the human experience, that AIDS be reduced or eliminated, that technologies be generated that do not contaminate, that others be generated that restore ecosystems, and that resources be utilized to generate jobs, local industry, and worldwide competition based on research into the furthestmost limits of knowledge and on academic excellence." These are still dreams, but all of these objectives are attainable.

ENERGY, ENVIRONMENT

Mexico: Resistol Group Initiates Environmental Megaproject

95WS0009B Mexico City LA JORNADA (R&D September Supplement) in Spanish 12 Sep 94 p 6

[Article by Laura Carolina Guzman Pena: "23 Cases of Patentability, Result of Resistol Scientific Research Megaproject"]

[FBIS Translated Text] *Focus has been on area of polymers; shift now under way to the environment.*

As the result of a scientific research project it created, the Resistol Industrial Group (GIRSA) will now commission studies to determine the possibilities of commercializing fusible adhesives and high-resistance polystyrenes with applicability in the production of refrigerators.

These two product lines are part of the 23 patentability studies generated by the Scientific Research Megaproject: Functionalization of Polymers for Alloying With Engineering Plastics. A total of 28 researchers from three

universities, the Saltillo CIAQ [Applied Chemistry Research Center], and the CID-Girsa [Girsa Research and Development Corporation] based in Ciudad Victoria, participated in this project.

In view of the results obtained under this megaproject and in prior experimental ties between academia and industry, the Resinol group will now launch an Ecology Megaproject.

Dr. Leonardo Rios Guerrero, manager of CID-Girsa, stated that with the commercialization of any of the 23 products generated by the research effort, at the industrial level and at the rate of from one to two tons annually, the company would recover its investment of 4.4 million new pesos.

Resistol, he said, wants to support us in the commercialization of the fusible adhesives line. These are environment-benign, in that they do not generate by-products. Moreover, they require raw materials that are cheap and easy to acquire. We still have some work to do in this field, but possibly within one or two years these products will be on the market.

In the polystyrene line, he said, there is one product that is highly resistant to chemicals. This type of polystyrene is useful in refrigerators requiring resistance to the present-day as well as new freons, and it is hoped that products in this line will be on the market by the end of this year. Rios Guerrero pointed out that the development of new polymeric materials is an advanced line of scientific research and of great interest to industry.

Speaking of the academic results achieved by the megaproject, he stated that it had generated 39 bachelor's, master's, and doctoral theses, 20 of which were completed and the rest still in process; 24 articles published in magazines with international circulations and 17 additional ones currently in preparation; and some 22 papers published in the proceedings of international symposiums. All of this, he emphasized, is in addition to the 23 current patentability studies.

Besides the highly chemical-resistant polystyrenes and the fusible adhesives, the scientists produced prototypes of products such as a writing-correction fluid, a varnish for bonding jigsaw puzzles, modified rubbers, highly shock-absorbent shoe soles, an adhesive for stamps and envelopes, and a highly shock-resistant nylon.

Developments include a coating for tile joints; a reactive, highly heat-resistant latex for PVC [polyvinyl chloride]; a removable-notes notebook; an environment-benign nail polish; and an adhesive for rubbers.

According to Dr. Leonardo Rios Guerrero, not all of these products are of interest to Resistol, but they may be of interest to other industrial groups. Such is the case of the latexes that are usable in the production of environment-benign nail polish, and of those that would enable an improvement of the thermal properties of PVC. As in

these cases, there are also other lines in which Resistol has no interest or lacks the capabilities to commercialize the products.

This project was funded by: CONACYT [National Council for Science and Technology] to the extent of 40 percent; CES, 35 percent; and GIRSA, 25 percent. The National Council for Science and Technology granted 1.76 million new pesos.

A total of 28 researchers took part in the realization of the project. UNAM provided 5 from its Department of Chemistry, 1 from its Institute of Physics, and 4 from its Materials Research Institute; UAM [Metropolitan Autonomous University] provided 4; University of Guadalajara, 3; CIAQ-Salttillo, 6; and the CID-Girsa, the remaining 5.

The megaproject took three years to complete and fomented the forming of a network of collaboration between the academics and the industrialists for the generation of new polymeric materials. Overall coordination of the megaproject was provided by Ciudad Victoria-based GIRSA.

Rios Guerrero, who favors imparting greater thrust to the efforts being made to bring academia and industry closer together, indicates that, to date, very few projects involving ties between universities and industries have been successful.

Among these, the following may be cited: the IMIQ [Mexican Institute of Chemical Engineers]-CONACYT-Industria Quimica, and the Plan for the Enhancement of Post-Graduate Courses in Polymers, which was the first systematic effort of its kind in this field and which involved ties between Resistol and UNAM, UAM-Iztapalapa, and University of Guadalajara.

Within this group, the following may also be cited: UNAM's Department of Chemistry Chairs Program; the agreements between Condomex and universities having as their object the development of human resources and developmental projects; the CYDSA programs with the Nuevo Leon Autonomous University and the Iztapalapa unit of UAM; and the Comex Program for the Development of Human Resources.

The GIRSA industrial group will now launch a new megaproject. The project will be joined by the DESC consortium, and is devoted to care of the environment, according to information provided by Engineer Leopoldo Rodriguez, deputy director of Resistol.

To this effect, he said, Resistol has commissioned a study, by UNAM'S CIT [Center for Technological Innovation], of the research centers that work on care of the environment. Engr. Rodriguez indicated that this new project will include three aspects, the first two with emphasis on academia, and the third oriented in the direction of the research centers and the personnel of business and industrial enterprises.

The first of these aspects will consist of the generation of scientific research; the second will point toward the training and development of teaching personnel with particular emphasis on the generation of postgraduates, and with a strong push to include protection of the environment in the curriculum for the bachelor's degrees in chemical engineering, chemistry, and physics; and the third aspect will focus on promoting the enhancement of skills, continuing education, and courses and degrees available to personnel working in the industrial centers.

The financing requirements of this megaproject aimed at the care and protection of the environment have not been worked out in detail as yet, but its total cost is estimated at several million dollars (possibly 6 or 8 million), owing to the participation of different industries.

The DESC consortium, which has decided to support the megaproject, is one of the country's largest. It includes around 50 companies, some in metalworking and

mechanical engineering, others in construction, agrobiological products, and the chemical sector. The latter encompasses Resistol Industries, which consists of approximately 16 companies.

Resistol Industries is pressing its quest for a clean-industry culture, which the entrepreneurs refer to as clean technology or clean chemistry, and which calls for the production of wealth and welfare without generating contamination. It is on this terrain that development of the environmental megaproject is to proceed.

There are various ways to correct the problems of contamination of the environment. Resistol's view, said Dr. Leonardo Rios Guerrero of CID-Girsa, is that the best way is to resolve the problem at its root. This means producing technologies that do not adversely affect the environment, doing away with the use of toxic solvents and by-products that are being channeled into rivers. And this demands a substantial effort. But the effort could be very much simpler if a larger number of industries were to join the project.

This is a U.S. Government publication. Its contents in no way represent the policies, views, or attitudes of the U.S. Government. Users of this publication may cite FBIS or JPRS provided they do so in a manner clearly identifying them as the secondary source.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. It should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed. Except for excluding certain diacritics, FBIS renders personal names and place-names in accordance with the romanization systems approved for U.S. Government publications by the U.S. Board of Geographic Names.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Central Eurasia, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be

provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735, or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.

END OF

FICHE

DATE FILMED

29 NOV 1994